Irish Short Sea Shipping
Inter–European Trade Corridors

NATIONAL DEVELOPMENT PLAN

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Your Plan – Your Future

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Further copies of this report may be obtained from:

The Irish Maritime Development Office, Marine Institute
80 Harcourt Street Dublin 2

telephone + 353 1 476 6500
facsimile + 353 1 478 4988
e-mail imdo@marine.ie
website www.imdo.ie

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Abridged Report

Logist*econ*
Economic and Management Consultants

ECORYS
Research and Consulting

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Executive Summary

1. This study by Logistecon Economic and Management Consultants, in conjunction with the Centre for Maritime Economics and Logistics at Erasmus University in Rotterdam and Ecorys Research and Consulting in the Netherlands, on behalf of the Irish Maritime Development Office, examines the potential for new sea routes to emerge in the Baltic region given the accession of new EU member States, and the possibility of increased road user charges in a number of EU countries[1].
2. The analysis is focussed on trade with countries in Northern Europe and on unitised transport. It examines the potential impact of the structure of trade and new trade partners on freight flows, the impact of the existing freight handling infrastructure in Europe on this structure, and the impact of the changes in relative costs on the decisions of freight forwarders in choosing routes and modes for the transport of Irish inward and outward freight.
3. The data on Ireland's trade with the study area show that both the value and weight of Ireland's trade flows with this area have grown rapidly. However, the value/volume density of goods being shipped is increasing (higher value, lower volume consignments).
4. Analysis of historical data and economic forecasts for the individual countries in the study area suggests that there will be growth in the volume of goods being transported and that these could give rise to new routes. Trade with the new member states is a very small part of Ireland's overall trade flows with the region. As a result, integration will lead to growth from a very low base.
5. Ireland has a somewhat unusual structure of freight handling with two ports – Rotterdam and Antwerp – dominating in LoLo, and the UK acting as a landbridge for a large proportion of RoRo freight destined for continental Europe. As a result, an analysis on the basis of origin/destination would be inadequate to explain the structure that exists, and therefore the likely impact of changes in the determining factors. The importance of logistics and supply chain management must be considered.
6. Consultations with industry operators indicate that transit traffic mixing with point to point traffic, the effect of logistics hubs 'pulling' traffic in certain directions, differences within and between inbound and outbound freight rates as a result of trade imbalances and factors surrounding port and shipping company choice are important issues in determining the structure of trade flows.
7. Because the structure of freight flows in Europe is not necessarily that which maximises welfare overall, although it may well be the most efficient from the point of view of freight transport costs, policy proposals have been developed. The potential impact of proposed new tolls in Europe, in particular the proposed German system (LKW-Maut) and UK tolls is examined.

[1] This report is an abridged version of a more extensive report submitted to IMDO. The longer report includes details of data and methodologies used in the work and a number of background appendices.

8. The potential impact on costs of new tolls across 28 different LoLo routes is calculated. For many of the most important destinations the impact would be negligible. With the possible exception of Warsaw where Gdynia offers a competitive alternative, the costs data back up the current structure of trade routes from Ireland, which are concentrated on transshipment through Rotterdam and Antwerp and overland transport to central European destinations.
9. A similar analysis is conducted for RoRo, taking Dortmund as a sample destination and using 5 different routes (3 over the UK landbridge and 2 direct to Continental Europe) from Ireland to this destination. The 3 routes over the UK landbridge had the highest total % cost increase as a result of new tolls (up to a 12% cost increase).
10. The impact of cost increases, as a result of the introduction of new tolls, on modal demand is calculated using appropriate demand elasticities. The analyses suggest that, in the case of LoLo, with increased road tolls greater use could be made of transshipment ports further East than is the case at present where transshipment through Antwerp and Rotterdam dominates. Specifically, this could result in some limited increase in traffic through Hamburg port and there may be some potential for a new route to Gdynia and/or Riga to develop.
11. In the case of RoRo and in the event of new tolls in the UK (which would have a significant impact on Ireland – Continental Europe transport costs for traffic which uses the UK landbridge), the analyses suggest a direct route between Ireland and Zeebrugge may be sustainable as the results indicate a relative and significant cost competitiveness gain for such a route. However, for such a new route to develop there are obstacles to be addressed, perhaps most important of which is the inertia that is in the system due to the costs of changing the extant structures that have evolved.
12. The conclusions of this work indicate that there is an opportunity for new short sea routes if tolls are introduced but that policy must promote change through providing information and research on new opportunities as they emerge, directly promote new routes through subsidies, and ensure that Irish ports are able to handle any new traffic. The work also identifies important deficiencies in the information that is available that inhibits adequate forward planning in this area.
13. Two recommendations for further work are detailed:
    (i) to examine the potential impact on Irish trade of road pricing in the UK, and
    (ii) a re-examination of the type of statistical data which is currently collected on maritime freight flows.

1.0 Introduction

As an island nation, it is clear that the competitiveness of transport linkages with the rest of the world, and in particular the rest of the EU, will have a considerable bearing on the overall competitive performance of the economy. It is estimated that in 2003, the value of exports from Ireland reached €112.7 billion. On the import side, the estimates indicate a value of €87.8 billion or 63.5% of GDP. Thus, the value of Ireland's international trade in 2003 was 145% the value of GDP for the year. Although the economics of transport mean that there is a greater propensity for higher value products to be transported by air, over 99% of Ireland's trade when measured by weight is transported by sea. The value of this has been growing rapidly over the past decade but there are a number of issues that affect the physical impact of this trade in terms of the handling of freight.

Changes in the structure of freight flows to and from Ireland are driven in part by international policy developments, particularly in the EU. Two developments are particularly important in terms of the focus of this study, namely the accession of 10 countries to the EU, which occurred on 1st May 2004, and the policy objective of the EU Commission to divert freight transport from roads to other modes.

It is known that a considerable proportion of Ireland's trade follows routes that involve transport to and from a fairly small number of ports in the EU that have shipping services with Ireland and transport overland to and from a wide range of destinations in Europe. This structure is primarily driven by commercial factors but the issues are complex with the physical imbalance of import and export volumes having an impact. It is clearly relevant to ask – given the changes that are occurring in the properties of the freight, the boundaries of the EU, the costs associated with transport on existing modes and the overall growth – whether there are opportunities emerging for the development of new short sea shipping routes. Identifying if such opportunities exist is the primary aim of this study. If the answer is positive then there may be implications for the infrastructure of Irish ports and shipping lines.

The study in this report is focussed on 12 economies in the North European and Baltic area. All are now members of the EU. In addition to drawing conclusions and providing recommendations, the work in this report can be divided into three main elements. The first is to provide a mapping of the structure of freight flows to and from Ireland, to provide projections of changes in Ireland's trade with other countries in the study area, and to examine the determinants of this structure. The second is to examine the cost variables in relation to this structure and to estimate the potential for imminent developments to affect this structure. The third is to examine the nature of the logistics sector in Europe and to provide indications of the potential response of this sector to changes in the policy and economic environment.

The main focus of the study is on unitised freight traffic (LoLo and RoRo). In the case of bulk shipping, the road transport leg is usually minimised in favour of both other land modes (rail and inland waterway) and having a greater proportion of the total journey by sea; as a result this trade would not be open to being affected by changes in land-based cost factors and including it in the analysis would possibly distort the picture.

2.0 Analysis of Ireland's Trade with the Study Region

2.1 International Trade and the Irish Economy

The sustained rapid growth of the Irish economy during the past decade has been widely discussed. Not all sectors have experienced similar rates of growth. Agricultural output as a percentage of GDP continues to decline while manufacturing output grew strongly during the 1990s. The most dramatic economic growth in recent years has occurred in the foreign traded sector of the economy. This has been sustained over a considerable period, with the result that it is generally accepted that Irish exports and the sectors that have contributed to export growth have been responsible for stimulating the remarkable performance of recent years. This is shown in Figure 2.1 which shows that throughout the boom period, export growth exceeded output growth in every year.

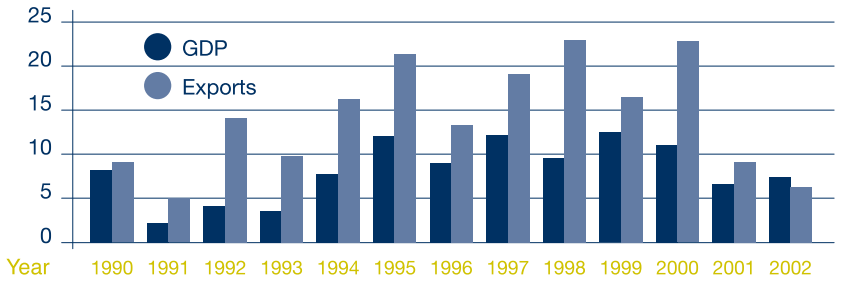


Figure 2.1: Ireland's Real GDP and Export Growth 1990–2002 (% per annum).
Source: CSO National Income and Expenditure

The rate at which Ireland's international trade grew in this period is remarkable. Exports from Ireland almost doubled in the period 1988 to 1994, and then repeated this feat in the 5 years to 1999. In the period 1995 to 2002 exports recorded an annual average growth rate of 14.3%. In this period imports also grew rapidly reflecting the fact that a considerable proportion of Ireland's imports are used for processing and re-exporting. However, the growth in the value of trade after allowance for inflation has been much greater than the physical volume and weight of goods carried.

This arises from the fact that the high-tech manufacturing sector has been the driving force behind Irish economic growth for a prolonged period. This is the case in almost every 5-year period between 1971 and 1999. In addition, this trend became much more pronounced during the 1990s. A second important point is that services became an increasingly important source of economic growth in the 1990s. This coincided with a rapid increase in international trade in services. However, the performance of traditional manufacturing sectors in this period was much weaker. As a result, the industrial structure of the Irish economy has changed considerably in a relatively short period and that internationally trading sectors have been the main drivers of this change. Increased productivity has been the key issue in

this regard with foreign-owned, high-tech industries taking a leading role. These firms rely on efficient supply chains for competitiveness and the availability of cost competitive transport to support their supply chains is a determining factor influencing the location of their manufacturing operations. This underlines the importance of ensuring that there are efficient external supply chains servicing the Irish economy.

2.2 Irish Trade Flows by Value

A total of 12 trading partners are deemed to be relevant to the analysis. While the use of the UK in providing a landbridge to final destinations means that cost conditions and transport infrastructure and policies in the UK are clearly important, the UK does not form part of the core study area. This section of the report concentrates on existing and prospective trade flows between Ireland and the states in this area. The countries included in our study ('the **study area**') are:

Belgium[2]	Netherlands	Denmark
Sweden	Finland	Estonia
Latvia	Lithuania	Poland
Czech	Republic Slovakia	Germany

Note: In our report the term '**accession states**' refers to those countries in the above study area who joined the EU on 1st May 2004, while reference to '**existing EU member states**' refers to those countries in the above study area who were already EU members prior to 1st May 2004.

Irish trade flows with these countries and recent trends are shown in Figure 2.2. At this stage, the precise modes and routes of this trade are not analysed. In the period 1993 to 2002, Irish imports from the area almost tripled in value growing by 193%. In this same period Ireland's exports to this region grew by almost a factor of 4 with a total rise of 294%. As a result, the trade balance moved strongly in Ireland's favour from a surplus of €3.8 billion in 1993 to a surplus of €18 billion in 2002, a rise of 368%. The outcome of this growth is that Ireland's exports to this region in 2002 were worth over 3 times as much as its imports.

[2] Data for Belgium include Luxembourg.

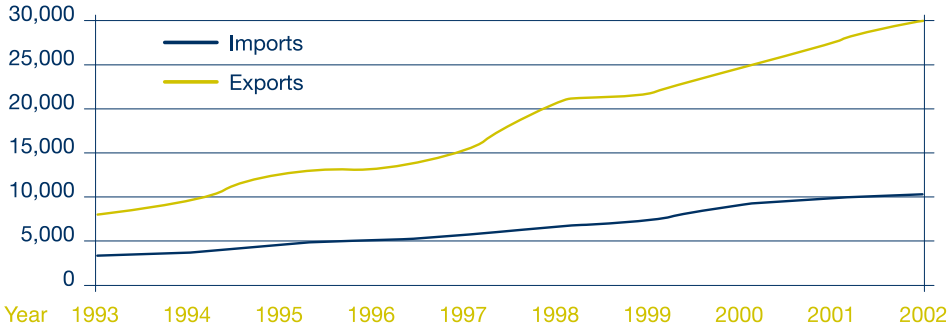


Figure 2.2: Trade with the Study Area (1993–2002, € million).

Together, Germany, Belgium and the Netherlands accounted for over 86% of the total trade, with the newly joined EU member states in total accounting for less than 3%. In this period, Ireland's exports to these countries grew by only 35% but imports grew by over 150%.

2.3 Ireland's Trade by Tonnage

This analysis of trade by value provides a background against which projections can be developed but is inadequate in terms of understanding trade flows. This requires that the physical volumes of trade are identified particularly since the changing industrial structure of the Irish economy means that while the value of trade might grow, its physical volume can fall. Figure 2.3 compares trends in the value of Ireland's trade with all countries, adjusted to remove the effects of inflation, with the weight of this trade and shows that there have been very pronounced trends in both. While the value has risen remarkably, the weight of Ireland's imports and exports has remained almost static for most of this period with a small decline in both in recent years. This implies that the value of Ireland's trade per unit of tonnage has risen very considerably.

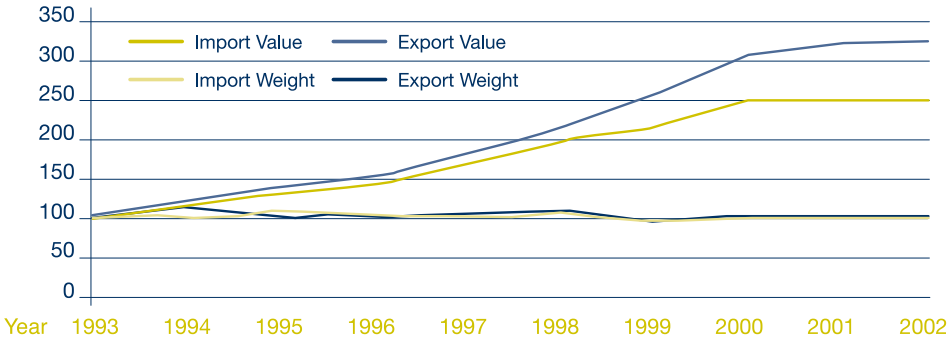


Figure 2.3: Weight and Real Value of Ireland's International Trade (1993 = 100).

This divergence in the trends in value and weight is also pronounced when only trade with the study area is included as shown in Figure 2.4. This divergence is particularly pronounced in the case of exports where the weight has fallen in recent years despite ongoing growth in value. This figure also indicates the considerable difference in the weight of imports and exports to and from Ireland and this area.

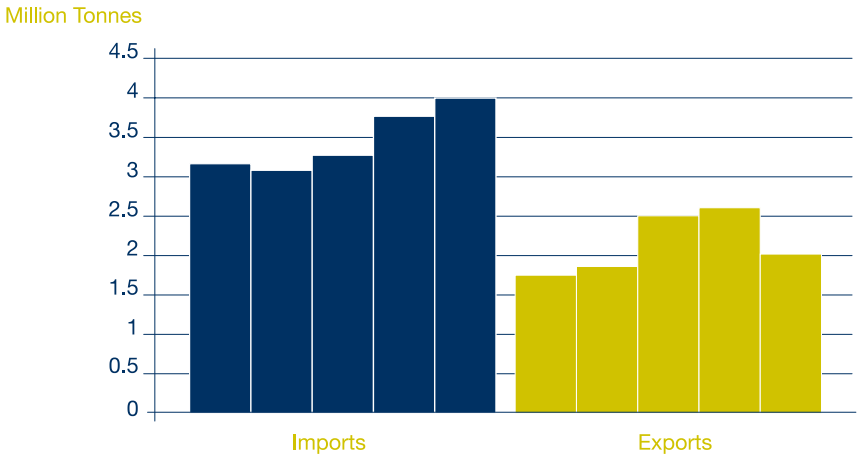


Figure 2.4: Trade with the Study Area by Weight (1993, 1995, 1998, 2000, 2002).

When measured by weight, three countries continue to dominate Ireland's trade with the study area with Germany, Belgium and the Netherlands accounting for 74% of the total. However, the accession countries accounted for 12% of trade with this area when measured by weight compared to only 3% when measured by value. This is a direct result of the lower value content of trade with these countries and reflects the different industrial structure of their economies when compared with existing EU member states. These trends mean that the volume of exports overall rose by only 7% and imports by 12% in this period, compared to a rise of 217% and 143% respectively in the value of trade after allowance for inflation. In the period 1998 to 2002, the weight of exports rose by 14.7% while the value rose by over 50%. One result of these developments is that the excess in the weight of imports over exports, which stood at 658,000 tonnes in 1998 (11.4% of total trade) rose to 1,766,000 tonnes in 2002 (28.9% of total trade).

The increasing divergence between the weight of exports and imports is important in determining the structure of freight flows and the routes used since it means that there is an in-built incentive for freight-forwarders to structure routes for Irish exports to be compatible with the routes being determined by imports to Ireland. This indicates that there will be the possibility that freight flows will not change in line with trade flows as identified by these data. These issues are dealt with in greater detail in later sections of this report.

These data also indicate the lightening of Ireland's exports that has been occurring in absolute terms and relative to imports. This trend is shown in Figure 2.5 with the impact of price changes removed. The data show that there were 302 tonnes of freight per €1 million of exports in 1993. This fell to just less than 146 in 1998 and had fallen to 82.5 tonnes by 2002. This fall of over 43% is far ahead of what might be accounted for by price changes and reflects the rapid change in the industrial structure of exports. The weight per € million of imports fell only about half as fast as in the case of exports in this period and remains at a much higher level. There are also considerable differences in the structure of trade with existing and accession states but these differences are reducing.

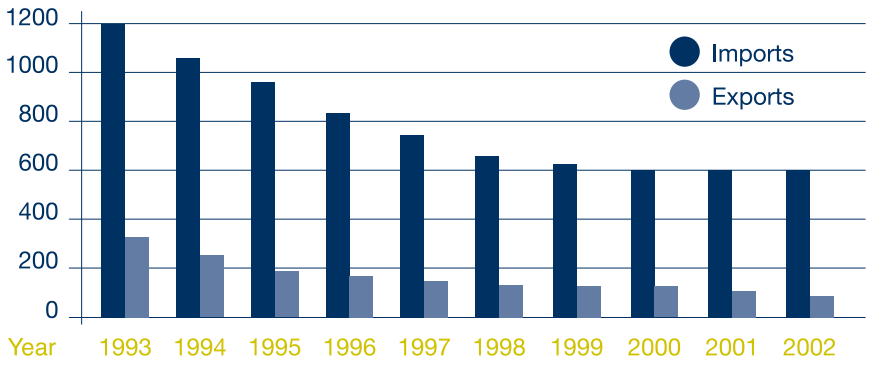


Figure 2.5: Tonnes of Irish Trade with the Study Area per € million (constant 1993 prices).

Box 2.1: Case Study illustrating value, volume and commodity trends – Ireland's trade with Poland

The major changes that have occurred in the industrial structure of the Irish economy is the primary cause of the trend in relation to the divergent growth of value and volume in Irish trade. This compositional structure is reflected in the products that comprise trade flows. This has been quite dramatic over even a short period of time and is seen whether value of volume measures are used. However, value measures tend to be very volatile so concentrating on the volume measures gets a better indication of real development.

CSO data uses the SITC classification. The data show that the weight of exports in SITC classifications 0 to 3 has tended to fall. This includes most food items and basic materials. However, there have been increases in SITC section 5 (Chemicals) and 7 (Machinery and equipment). These sections include the pharmaceutical and computers industries. On the import side, most sections have tended to show increases with the largest increases in the manufactured goods category, SITC 6. These trends are seen in trade data for both the existing EU member countries and accession states but are more pronounced for the latter group. Poland, which is by far the largest economy among the accession states, illustrates this trend.

In the period 1998-2002, the weight of Ireland's exports to Poland fell by 56% while the weight of imports rose by 18%. Furthermore, the weight of imports was over 8 times as great as exports in 2002. For the accession economies in particular, the greatest increases in trade volumes arise from the most rapidly growing parts of the economy. The importance of this is that these sectors are also those where the lightening effect has been very pronounced. For example, in the case of Ireland's exports to Poland, the value of exports of pharmaceuticals (SITC 54) rose from €24,700 a tonne in 1998 to €48,370 a tonne in 2002. For office and telecommunications equipment (SITC 75 & 76), the value rose from €67,280 to €78,800. These two industries are driving the export growth to this market and contrast with an over value of €5,880 per tonne in 2002.

2.4 Projections of Ireland's Trade Growth with the Study Area

Although value-based trade data are inadequate for the purposes of describing the flows of freight to and from Ireland, they are useful in providing a basis for projecting the future growth of trade. Rather than basing the projections for Ireland's imports and exports on factors in the Irish economy – which is the usual method used to forecast exports and imports – the projections have been based on economic forecasts for the individual countries in the study area. These are derived from forecasts produced by the European Commission.

Growth in the accession countries is expected to be considerably higher than in existing EU members over the short term. This is reflected in forecasts for export and import growth for these countries. Many of these economies are projected to grow trade values by 10% per annum or more in the next few years.

These official forecasts are short term and it is necessary to project somewhat further for the purposes of this study. The following assumptions are made. After 2005, GDP and trade growth in existing EU member states will slow to 2% and 4% per annum respectively up to 2008. Accession states will grow more quickly and the projection is for average real GDP growth of 4% per annum for this period with the value of trade growing at 8% per annum in real terms. These assumptions allow for a projection of Irish trade with countries in the study area in 2008 as shown in Table 2.1.

Table 2.1: Projected Value of Irish Trade with the Study Area in 2008.

	Exports		Imports	
	2008 Forecast € million	% Growth Since 2002	2008 Forecast € million	% Growth Since 2002
Belgium	17,276	19.3	1,032	19.4
Netherlands	4,232	24.1	2,282	22.7
Denmark	669	25.9	922	27.0
Sweden	1,584	33.7	561	34.2
Finland	385	27.1	944	28.1
Estonia	52	63.0	40	64.6
Latvia	27	69.2	44	69.2
Lithuania	27	61.6	38	58.2
Poland	485	70.7	195	61.0
Czech Republic	293	48.6	182	47.8
Slovakia	72	81.1	29	69.4
Germany	8,832	31.0	4,420	25.5
Total Area	33,933	24.6	10,687	26.3

As already noted, this cannot be interpreted as a projection of future flows of goods but only of the value of goods. This provides an indication of the economic background against which future flows will develop. However, the volume of trade flows will depend on a combination of this growth due to economic factors and changes in the composition of exports that affect the physical characteristics of these goods. As a result, the projection must combine the growth implied by economic developments with the observed trends in the weight of trade flows identified above.

The data on the weight of exports and imports, i.e. tonnes per € million, indicate that, after allowance for inflation, the weight per € million of exports to existing member states fell by 68.3% in the period 1993–2002 while the same measure for imports fell by 87.2%. In the case of the accession states, the falls were 49.1% for exports and 71.7% for imports. These trends imply average annual declines of 12% and 7.3% for exports and imports to existing states and 20.5% and 13.1% for exports and imports in the case of accession states. These trends are continuing and some account must be taken of this trend in projecting the volume of future trade flows. This reflects the changing nature of Ireland's international trade. However, it would not be appropriate in this projection to maintain that this trend will continue along recent lines. First, the Irish economy undoubtedly underwent major changes in the period 1998 to 2002 and the rate of this change is likely to slow in the future. Second, the value projection has been made on the basis that the value of Ireland's trade rises in line with total imports and exports to these countries. In recent years this has not been the case as Ireland's trade values, particularly its exports have risen much faster. The underlying reason is the change in the structure of the economy. As a result, an assumption that Ireland's trade values will rise in line with overall trade is an implicit assumption that this underlying change will be much less.

To reflect these arguments but to maintain that there will be some ongoing lightening of trade even under these assumptions, the projection of the future weight of trade was done assuming that the rate of lightening of trade slows to one-third of its previous rate in the period to 2005 and then to 20% of the previous rate in the years 2005 to 2008.

Under these assumptions, the weight of exports rises by 16.8% in the case of existing EU members and by 17.5% for the accession states in the study area in the years 2002 to 2008. The weight of imports rises by 10.7% and 30.5% respectively for these countries. As a result, it is clear that the projected growth of trade with these countries will have an impact on the weight of trade flows provided there is a slowdown in the trend towards ever lighter trade. In total, this growth would lead to an additional 367,000 tonnes of exports to this area and an additional 554,000 tonnes into Ireland.

The percentage change in the weight of trade by country is illustrated in Figure 2.6. All have positive growth although this is negligible in the case of exports to Lithuania and the Czech Republic.

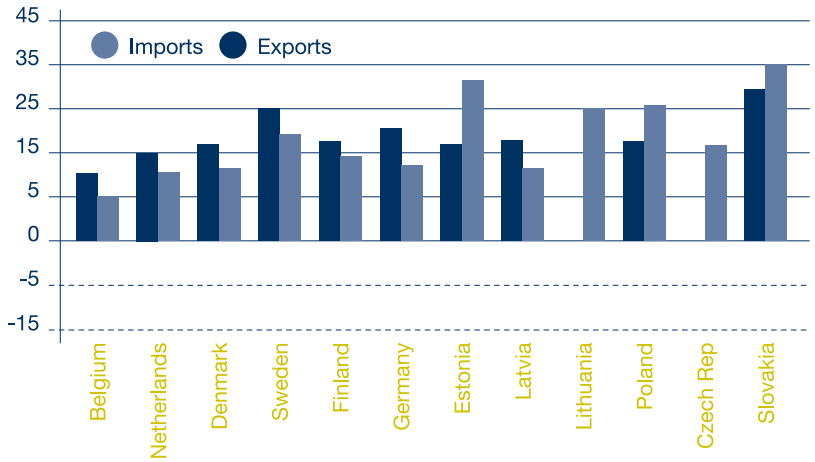


Figure 2.6: Projected Percentage Change in Weight of Trade during period 2002–2008.

One notable outcome of these projections is that the relative weights of imports and exports continue to diverge. When the lightening of trade is assumed to slow the indication is that the tonnage of imports to Ireland from the study area will be about 1.75 times the tonnage of exports to this region in 2008. In the case of the accession states alone, the weight of imports rises to about 11 times the weight of exports. While the growth possibility suggests that there might be an opportunity for a new route to emerge to service this trade, this imbalance is a major issue to consider in determining the viability of such a route.

2.5 Potential Impact on Freight Movements

While the projection in this report provides overall estimates of developments, the impact of this on freight transport can be complicated by the fact that the number of LoLo routes and their frequency will depend on the number of TEUs to be transported. The complications arises due to the fact that as the nature of the goods to be transport changes i.e. the value of goods per tonne of freight increases, this may not translate directly into changes in the number of TEUs. Indeed, it is very likely that there will be a fall in the average weight of goods carried in loaded containers either because they are unfilled, because there is a growing number of empty boxes to be transported or because the higher value goods are transported with an increasing amount of low weight/high bulk protective packaging. The problem is that there is no basis on which to predict how this relationship between the overall value per tonne of freight and the weight per container will develop.

As a result, any projection of the number of TEUs must be regarded as somewhat speculative. With due recognition of this issue, Table 2.2 contains projections of the number of LoLo TEUs on the major routes. The data for 2002 in this Table are taken from Section 3.2, and are based on the survey of ports, which will be discussed in that section.

Table 2.2: Projected TEUs by Route, 2008, Alternative Scenarios.

Exports	2002	2008	2008 (-5%)	2008 (-10%)
Non-Dublin via Belgium	21,322	24,521	25,812	27,246
Non-Dublin via Netherlands	96,242	109,633	115,403	121,814
Dublin through B and NI	138,468	165,580	174,295	183,978
Total exports	256,032	299,734	315,510	333,038
CEECs only	12,801	15,930	16,769	17,700
Imports	**2002**	**2008**	**2008 (-5%)**	**2008 (-10%)**
Non-Dublin via Belgium	16,497	18,005	18,953	20,006
Non-Dublin via Netherlands	84,408	91,873	96,709	102,082
Dublin through B and NI	144,155	161,741	170,254	179,712
Total imports	245,060	271,620	285,915	301,800
CEECs only[3]	8,822	11,405	12,005	12,672

The initial estimate for 2008 is provided by these data inflated according to the projected growth in the weight of exports and imports as calculated in Section 2.4. This assumes that there is no change in the average weight of containers and that the existing modal distribution is maintained over this period. The alternative estimates – described as 2008 (-5%) and 2008 (-10%) – are calculated on the basis that there is a 5% and 10% fall respectively in the average weight of the material per container over this period.

These projections show increases in the number of containers on these routes for both exports and imports. On the export side, the projections indicate that the number of LoLo TEUs would grow by between 17% and 30% on these routes in this period, between about 2.5 and 4.5% per annum. For imports, the growth is in the range of 11% to 23%, between about 1.7 and 3.5% per annum. These trends are illustrated in Figure 2.7 overleaf.

[3] Accession countries in Central and Eastern Europe.

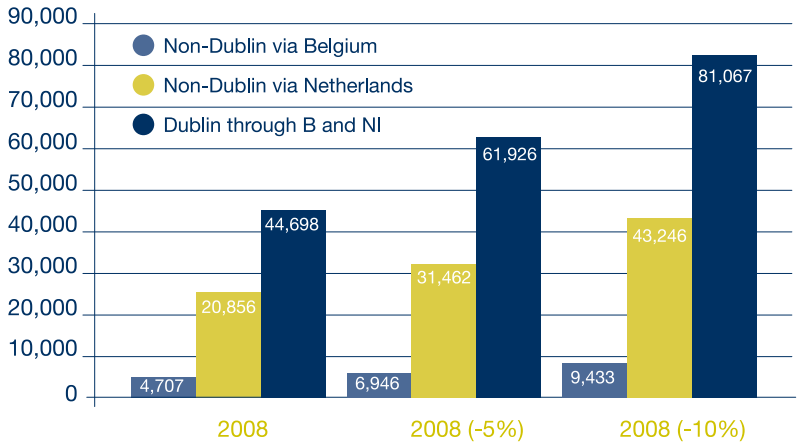


Figure 2.7: Projected Growth in LoLo Flows by Route, Exports plus Imports, in 2002–2008 (TEUs).

If trade with the accession countries only is included, then the rates of increase are greater. The number of TEUs in LoLo exports to these economies would increase by between 24% and 38% in this period, equal to annual growth of about 3.7 to 6%. For imports, the number would grow by between 30% and 44% over the period, with annum growth of about 4.5% to 7%. This is quite rapid growth, particularly is the scenario of a 10% fall in the average weight of TEUs is accepted, and with a combined loading of about 30,000 TEUs per annum suggests an opportunity for a new route. However, an important issue is that the number of TEUs to these economies would still account for less than 5% of the total LoLo traffic on the routes examined, up from about 3.6% in 2002. Given the structures and determinants of freight flows as discussed in Section 4 of this report, it cannot be concluded that this will be sufficient to lead to new routes as freight forwarders and logistics providers will have an incentive to keep this freight integrated with existing flows. However, the introduction of new tolls as discussed in Sections 5 and 6 could alter this conclusion.

This analysis suggests that, despite the importance of trade to the Irish economy and the projected growth of trade with the EU and the new members of the EU in particular, it cannot be concluded that the accession of these new states, while contributing to the gradual move eastwards of the centre of economic gravity in Europe, will impact on freight flows from Ireland to Europe in a major or predicable manner. Under certain assumptions there are reasons to conclude that there will be growth in the volume of goods being transported and that these could give rise to new routes. However, this conclusion is tentative given the small proportion of trade accounted for by the new member states and requires recognition of the determinants of trade flows. This analysis is undertaken in the next two sections of this report.

3.0 Structure of the Irish Maritime Transport Sector

3.1 Freight Flows and the Port Sector

3.1.1 Structure of Flows

The port sector has changed radically in recent decades. In the past, competition between ports was minimal and port-related costs were relatively insignificant in comparison to the high cost of both ocean and inland transport. Indeed as a result there was in the past little incentive to improve port efficiency. Today, however, most ports are competing with one another on a global scale and, with the tremendous gains in productivity in maritime transport achieved over past decades, ports are now perceived to be the remaining controllable component in improving the efficiency of ocean transport logistics.

CSO data record trade through 21 ports for 2002, but it is clear that most ports are relatively small with just 3 ports – Cork, Dublin and Shannon-Foynes – accounting for 80% of the total. Out of a total of 44.9 million tonnes, almost 15.4 million (34.2%) was unitised with the remainder in bulk or break bulk form. Some specialisation is evident in some ports with only Dublin, Cork and Waterford handling all categories of freight. Given that the focus of this study is primarily on unitised freight flows, the ports of Cork, Drogheda, Dublin, Dun Laoghaire, Rosslare and Waterford are of relevance.

An important categorisation of trade through ports is by the mode of transport used. In terms of this study two modes are important: RoRo and LoLo unitised freight. The chosen mode will depend on a number of factors including the nature of the goods and the relative costs of transport. The transit time each takes is also a relevant consideration. When rapid delivery is the key requirement, RoRo freight will be the chosen mode. Analysis of trade through Ireland's ports by region of origin/destination shows that almost 42% of freight passing though Irish ports either arrives from or is destined for ports in the UK. If only the 7 ports that handled unitised trade are included then this proportion rises to 52%. This is greater than the percentage of total Irish trade accounted for by the UK due to the use of the UK as a landbridge and the relatively lower value per unit of weight of trade with the UK, partly as a result of the importance of this market for traditional Irish industry which tends to concentrate on the UK market.

The pattern of trade through the ports has reflected the changes that have occurred in the economy with rapid economic growth resulting in considerable growth in the traffic through the ports. In the period 1995 to 2002 the total tonnage passing through the ports grew by 38.7%. However, there has also been a considerable change in the nature of the traffic as evidenced by the fact that containerised traffic overall grew by over 90%, with RoRo growing much faster in the period by over 142% in total. The result is that the percentage of total freight handled in the form of RoRo grew from 12% in 1995 to 21% in 2002.

These data reflect the fact that the freight passing through Irish ports requires more careful management in terms of the physical handling of the goods and also their efficient transit through the port. Furthermore, Irish economic growth has implications for the modes adopted in the transport of output with high growth in the RoRo mode. Important as the growth in trade has been to wealth creation in recent decades, the gains are magnified by the ability of firms to utilise the efficiency gains that have accompanied this growth. The efficiencies do not just result in lower costs as would be concluded by a static model of world trade but have led to the growth in the importance of supply chains in determining competitiveness and to the development of new business models and patterns of trade as firms move to exploit the opportunities that are created.

The ports have handled the increase in trade but there are indications that some constraints are being approached. Research undertaken in the late 1990s examined capacity, capacity utilisation and future trends in port activities. The study provided estimates of future trade growth based on statistical models that were fitted to each type of cargo for inwards and outwards traffic, giving a relation between growth rates for Irish GNP and each cargo category, after adjusting for the specific factors. This work showed that some ports will simultaneously experience shortfalls and surplus in different operations in 2007. In general, there would be surplus capacity in a number of ports in bulk handling – with shortfalls in Dublin and Cork – and smaller surpluses in general goods capacity. However, the forecast is for a major shortfall in unit load capacity in Dublin of 5.6 million tonnes per annum, with smaller shortfalls of 800 tonnes and 500 tonnes in Cork and Waterford respectively. Given the key role of supply chains in the competitiveness of modern firms, any such deficit in capacity is likely be interpreted as a reduction in the overall competitiveness of the Irish economy as a location for production.

3.1.2 Government Policy and Irish Ports

Failure to satisfy the demands of consignors and consignees can only result in non-optimisation and increased costs throughout the supply chain, ultimately rendering international supply chains with nodes in Ireland less competitive. This can seriously harm national competitiveness. As a result, policymakers and operators in the wider economy also have an interest in the structure of freight flows and Ireland's ports underwent considerable change in the 1990s as a result of policy developments. In 1991 the Government established a review group to examine the policy and legislation governing commercial ports in Ireland. The report in 1992 of the review group had considerable implications for Irish ports and led ultimately to the 1996 Harbours Act which corporatised the main commercial ports[4].

[4] Report of the Review Group on Commercial harbours and Pilotage Policy and Legislation, Government of Ireland (1992).

While not recommending immediate privatisation ('the privatisation of ports is not realistic at this time, but is an option that should not be ruled out for the future')[5], the shift towards corporatisation recommended by the report had the effect of 'freeing Ireland's key ports from direct departmental control and giving them the commercial freedom they need to be able to operate as modern, customer-oriented service industries'[6].

In 2002 the Government commissioned a High Level Review (HLR) of the State Commercial Ports to inter alia conduct a detailed evaluation of the current model for the governance of Irish ports. The report broadly supported the extant model of port governance in Ireland. While not ruling out privatisation, the HLR recommended that privatisation is not pursued at present and that more emphasis is placed on public private partnerships (PPP) for various aspects of port operations. In 2002 the Government published the report of the Task Force on Transport Logistics in Connection with Ports. That report highlighted the key role played by ports in the context of logistics competitiveness and the Irish economy and added that freight transport should be identified as a sector of primary national interest. Table 3.1 details key features of Ireland's main ports. All of the ports listed (with the exception of Rosslare) have a commercial mandate and operate as corporatised ports under the 1996 Harbours Act with their Boards appointed by the Minister for Communications, Marine and Natural Resources. Rosslare is also run as a commercial entity and is currently under the aegis of CIE and the Department of Transport.

Table 3.1: Key Features of Ireland's Main Ports.

Port	Passengers and Freight?	Traffic types handled	Total Freight Volume Handled ('000 tonnes)	Weekly unitised shipping services*
Cork	Yes	RoRo, LoLo and Bulk	9,042	15
Drogheda	No	LoLo and Bulk	1,369	3
Dublin	Yes	RoRo, LoLo and Bulk	15,557	110
Dun Laoghaire	Yes	RoRo only	146	21
Rosslare	Yes	RoRo only	1,926	39
Shannon-Foynes	No	Bulk only	10,418	–
Waterford	No	LoLo and Bulk	1,910	13

Source: CSO Statistics of Port Traffic 2002
*Data on weekly services are minima and are approximate as some services are seasonal, some can operate to irregular schedules, etc.

[5] Ibid.

[6] Quoted in: Mangan, J. and F. Furlong (1998) Strategies for developing commercial port administration in Ireland, Maritime Policy and Management, Vol. 25, No. 4, 349-360.

Competition in the Irish ports and shipping sectors is now quite extensive. As is the case internationally, high fixed costs commit operators to react strongly to new entrants and lead to an emphasis on volume and on marginal income. Notwithstanding, new routes do emerge and operators also sometimes shift existing services to alternative ports. Two developments in vessel technology may impact the structure of the Irish maritime freight sector in the future. First, LoLo vessels are becoming faster and more efficient and thus may take some traffic which previously was exclusive to the RoRo mode. Second, new vessel builds in the deep sea container trade are getting progressively larger to the extent that increasingly only some ports will be able to handle these large mother vessels. 'Hub and spoke' networks are thus emerging with many non-hub ports providing feeder services to these hubs rather than point-to-point direct services. The factors that impact on port performance through route choice are considered in Section 4.

3.2 Analysis of LoLo Freight Flows by Route

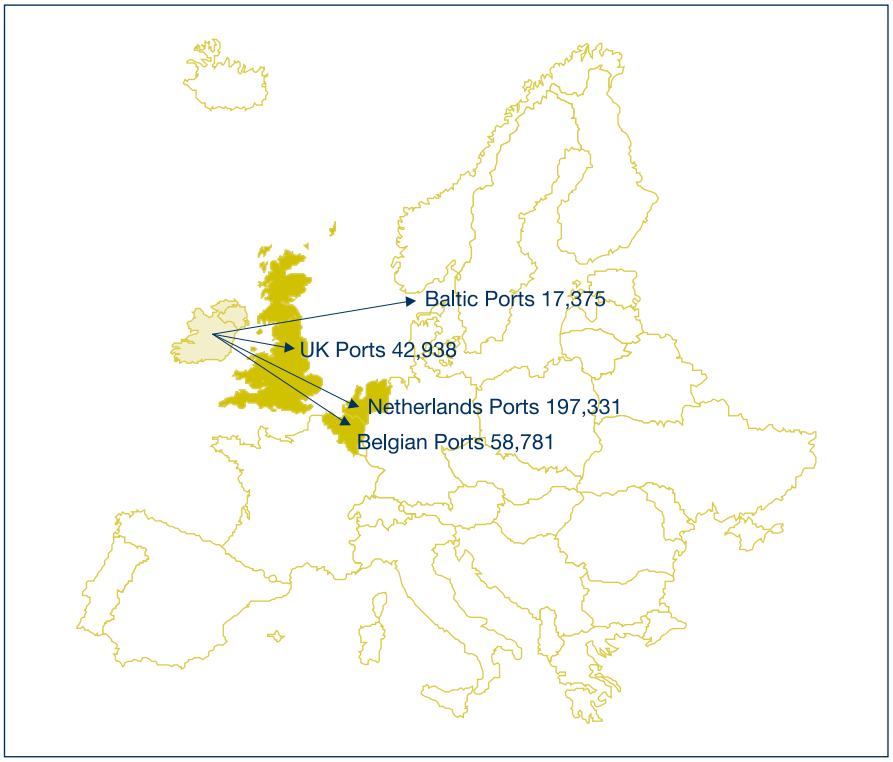
3.2.1 LoLo Shipping Routes from Ireland

Four Irish ports have LoLo services with the UK and Continental Europe. Dublin has the largest number of routes while across all ports the most prevalent destinations are UK ports and the ports of Rotterdam and Antwerp.

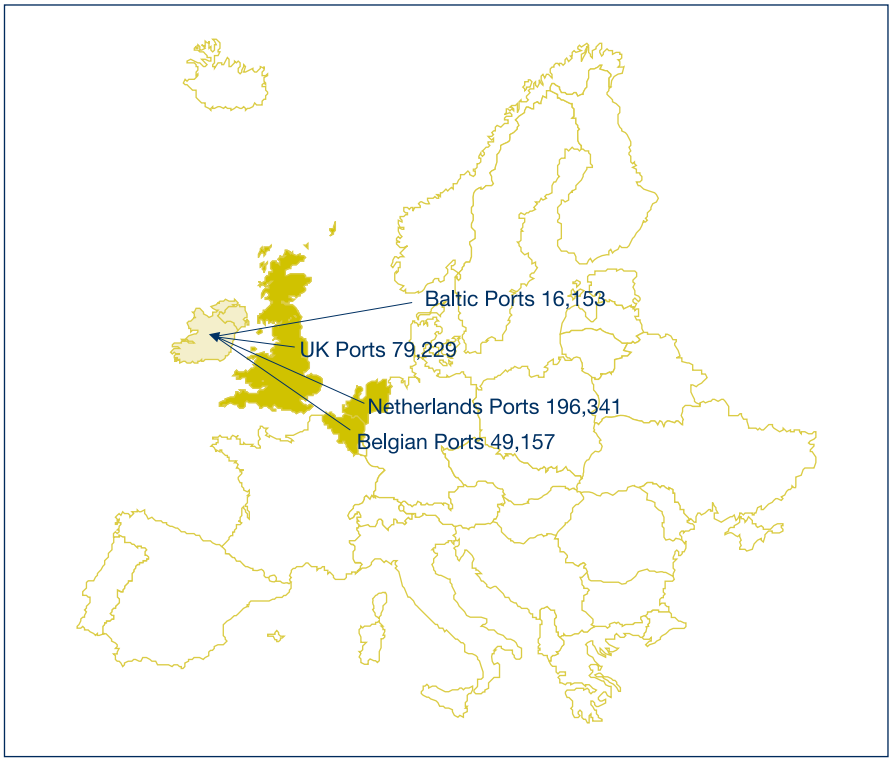
Official statistics do not identify trade flows according to the actual origin-destination route taken but merely in terms of the destination country, in the case of CSO Trade Statistics, or the origin and destination port, in the case of CSO Port Statistics. Thus, it is not possible to construct a map of trade routes from these sources. To get around this problem, a questionnaire was sent to Irish ports and followed up by interviews with port representatives and with others in the shipping and freight forwarding sectors. The analysis in this section is based on the replies to this questionnaire and the follow-up consultations and refers to unitised freight only.

3.2.2 LoLo Freight by Route

Maps 1A and 1B shows the total flows of LoLo TEUs to/from the first port of call. In total, these data suggest a certain imbalance in flows but when trade with Britain is excluded there is almost balance in terms of inflows and outflows of TEUs with the continental ports.



Map 1A: LoLo Trade by Partner Port (Export TEUs).
Source: Logistecon analysis (2004).

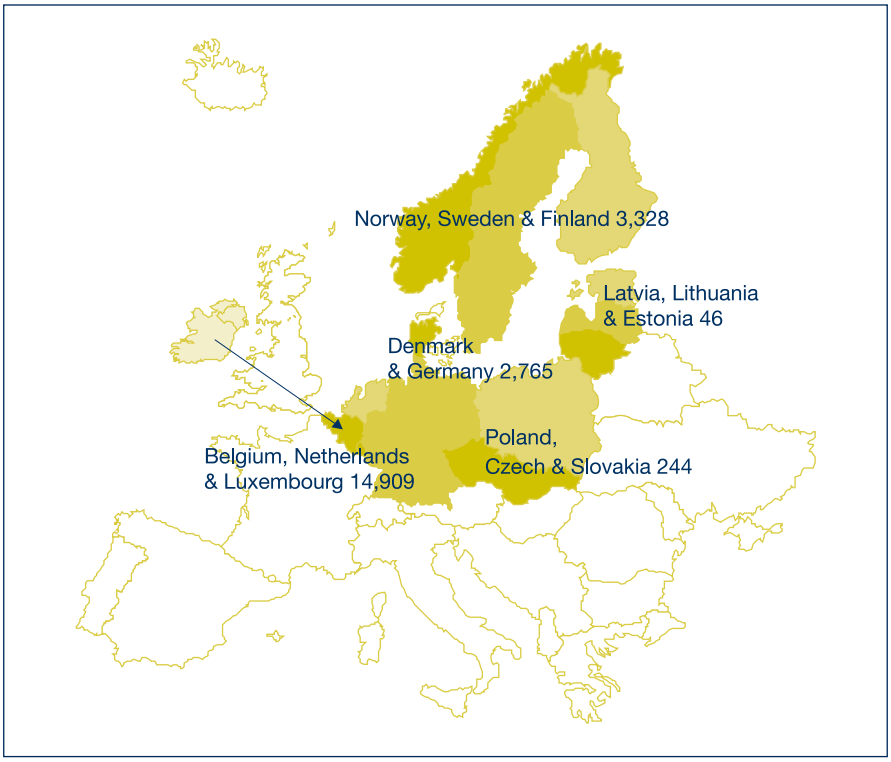


Map 1B: LoLo Trade by Partner Port (Import TEUs).
Source: Logistecon analysis (2004).

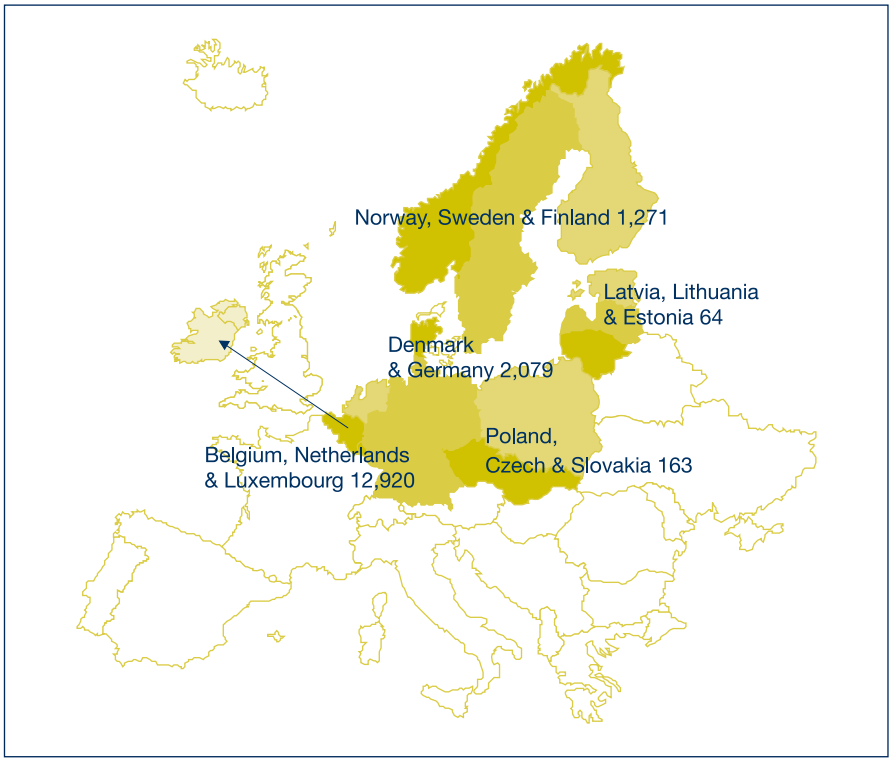
When UK flows are excluded, it is clear that the vast majority of this traffic passes through Belgian ports (19.5% of imports and 17.9% of exports, mostly Antwerp), and Netherlands ports, (Rotterdam 74.5% of imports and 72.6% of exports). Clearly then the work needs to concentrate on these two flows.

The quality of the data that are available on the routes taken by freight through and from Ireland varies depending on the port through which it passes. Ideally, data would be available for all Irish ports to/from final destinations and origins. However, only Drogheda and Cork ports could supply this detail. In the case of Dublin and Waterford it has been necessary to disaggregate the data to get the routes beyond the first/last port outside Ireland. In the case of Waterford it has been deemed appropriate to assume that the routes for containers to/from Rotterdam and Antwerp are the same as in the case of Cork.

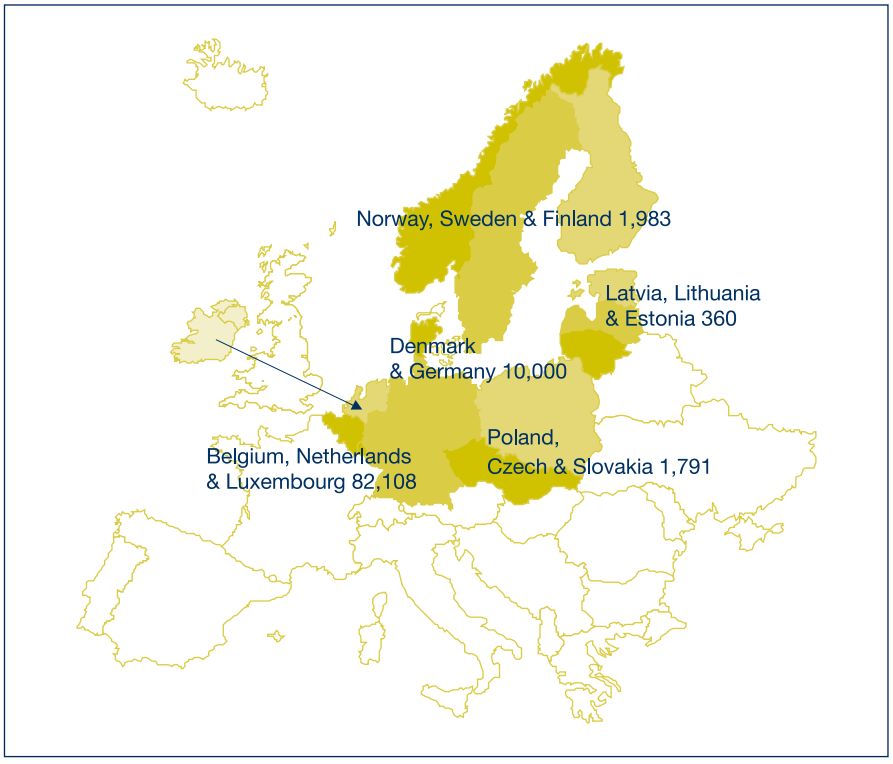
This distribution is shown in Maps 2A and 2B for Belgian ports. Maps 3A and 3B shows the distribution of freight through Netherlands ports. Routes from Cork and Waterford have been aggregated and distributed by region according to the Cork flows. Drogheda is then added to these flows. This is undertaken because some ports are concerned about confidentiality if the analysis was done on the basis of identifiable flows.



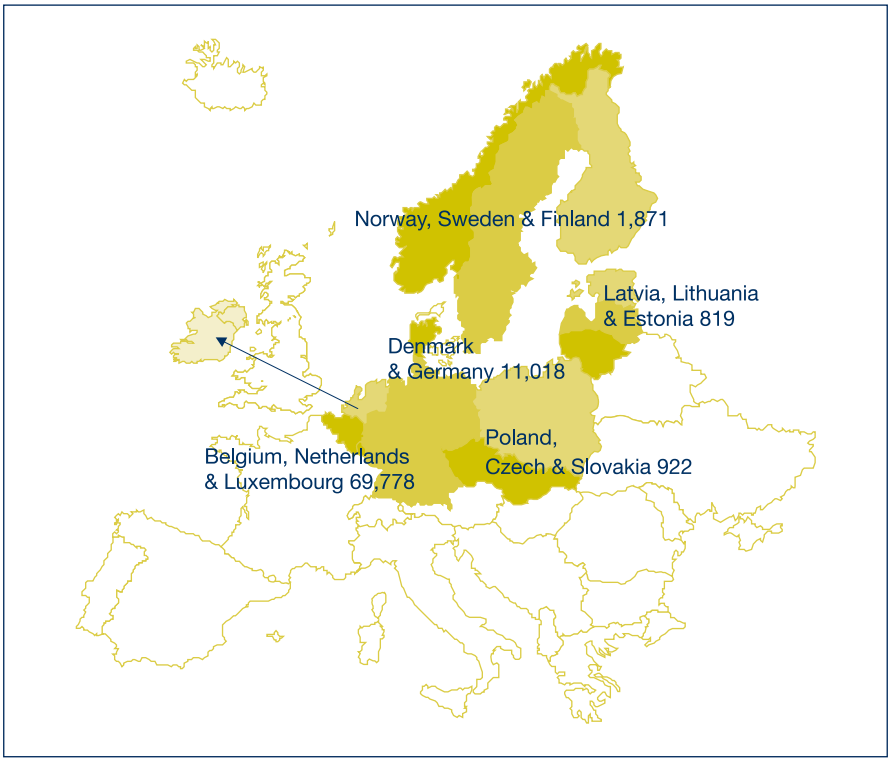
Map 2A: Non-Dublin LoLo Freight through Belgian Ports by Final Destination (Export TEUs).
Source: Logistecon analysis (2004).



Map 2B: Non-Dublin LoLo Freight through Belgian Ports by Freight Origin (Import TEUs).
Source: Logistecon analysis (2004).



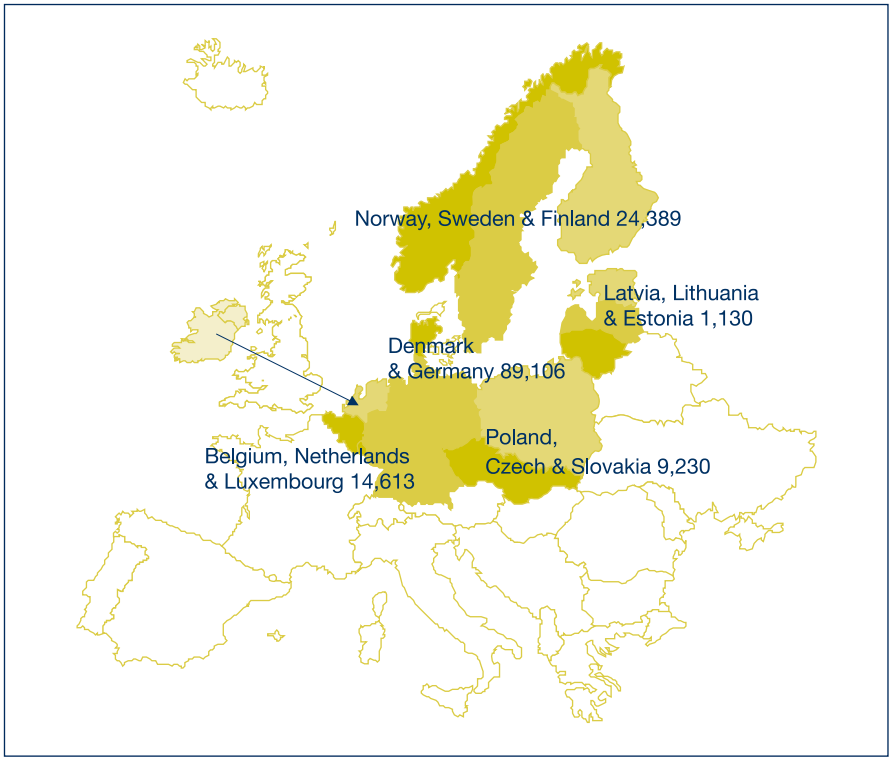
Map 3A: Non-Dublin LoLo Freight through Netherlands Ports by Final Destination (Export TEUs).
Source: Logistecon analysis (2004).



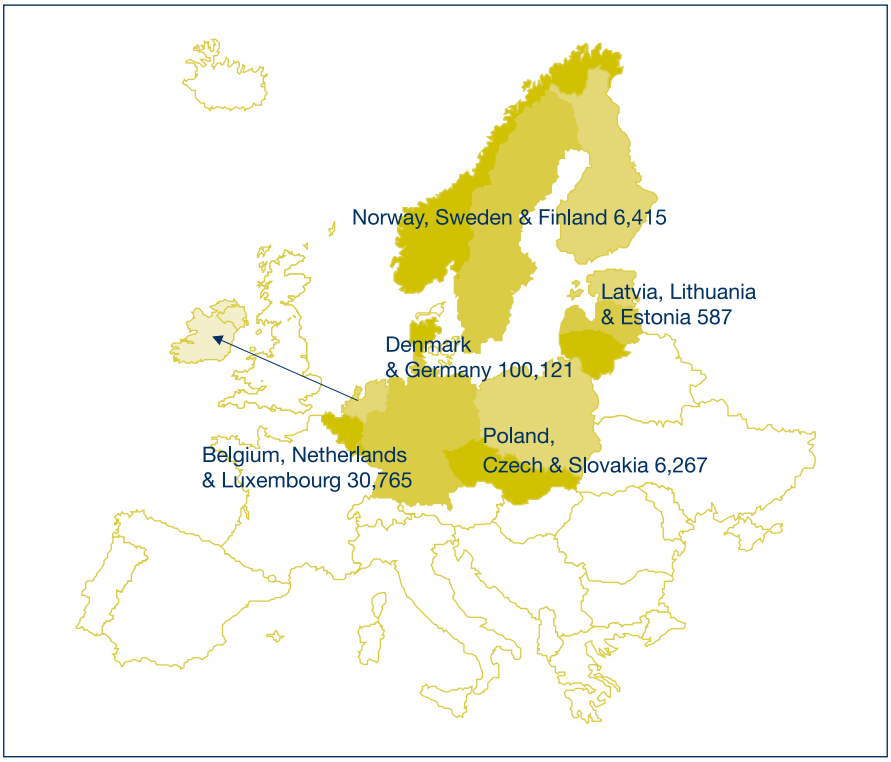
Map 3B: Non-Dublin LoLo Freight through Netherlands Ports by Freight Origin (Import TEUs).
Source: Logistecon analysis (2004).

Identifying freight flows in the case of Dublin poses a greater challenge because of its size in terms of the overall transport flows and the greater number of countries, which it appears reasonable to assume, will be involved. While it is possible to identify the first/last port for the Dublin traffic, it is necessary to aggregate the freight through Rotterdam and Antwerp if the remainder of the routes are to be estimated. Other flows through Swedish and German ports are small and it is assumed below that this freight remains in these countries. The methodology to disaggregate the Dublin flows is based on a separate dataset from the Central Statistics Office. This dataset shows the weight of imports and exports by final country but not the routes taken. The approach taken was as follows. First, the total weight was broken down by SITC sector. On the basis of discussions with transport and port operators, each 2 digit sector was assigned a percentage according to the estimated proportion of LoLo freight in the total freight in that SITC division. In some cases this was either 0% or 100% but intermediate values were also used where mixed modes are likely to be used. This then gives the total weight of freight by trading partner that is carried by LoLo. It was then assumed, again on the basis of contacts, that LoLo exports and imports to Ireland have an average weight of 10 tonnes per TEU. This allowed for the calculation of total TEUs to each trading partner.

This then allowed for the distribution of total LoLo freight among the regions to be calculated and this distribution was than applied to the number of TEUs from Irish ports to Europe via ports in Belgium and the Netherlands to give the freight flows shown in Maps 4A and 4B. The flows already identified in Maps 2 and 3 were subtracted from the resulting estimates thus giving the flows of LoLo to and from Dublin via Rotterdam and Antwerp.



Map 4A: Dublin LoLo Freight through Belgium & Netherlands Ports by Final Destination (Export TEUs).
Source: Logistecon analysis (2004).



Map 4B: Dublin LoLo Freight through Belgium & Netherlands Ports by Freight Origin (Import TEUs).
Source: Logistecon analysis (2004).

This provides an indication of routes between Dublin and Northern Europe for LoLo freight.

3.3 Analysis of RoRo Movement via UK Landbridge

Four Irish ports have RoRo services. Data supplied by Dublin Port show that most of their RoRo activity involved travel to the UK. Combining imports and exports, Rosslare handled 1,583,000 tonnes of UK freight and 343,000 tonnes of freight to and from France. CSO Port Statistics 2002 indicates the export tonnage through Rosslare to the UK in 2002 was 825,000 tonnes. In the case of Dun Laoghaire, all freight is RoRo with the UK as the first port of call. The average freight tonnage per RoRo vehicle through Dublin was 15.5 tonnes. Total tonnage through Dun Laoghaire in 2002 was 55,000 tonnes forwarded and 91,000 tonnes received. Table 3.2 shows the total number of RoRo units handled at the ports in 2002.

Table 3.2: RoRo Units through Irish Ports.

	Forwarded	Received	Total Units	Tonnage (000's tonnes)
Dublin	257,382	197,114	454,496	7,070
Cork	1,555	2,157	3,712	43
Rosslare	56,950	47,768	104,518	1,797
Dun Laoghaire	15,621	14,714	30,335	146
Total	331,508	261,753	593,061	9,056

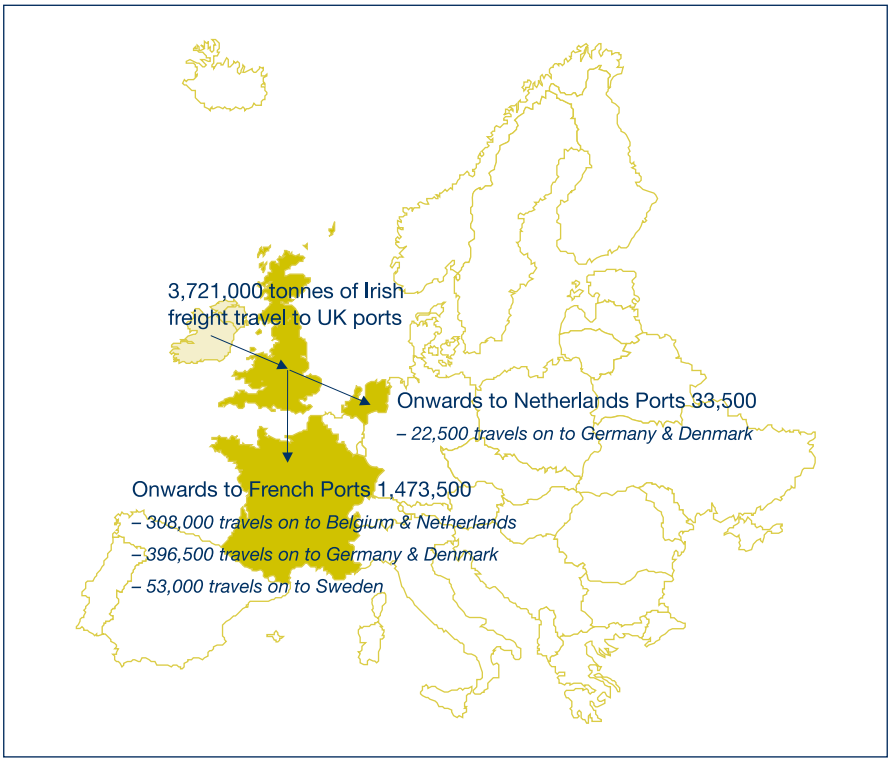
Source: CSO Port Statistics 2002

The published CSO data for RoRo freight flows to the UK relate to the first port of call only and it is known that a proportion of this traffic will proceed through the UK to other destination countries. Further analysis of these flows is possible by accessing data produced by surveys in the UK and VAT returns in Ireland. The Department for Transport in the UK carried out a survey of foreign vehicles over a six-week period during June and July 2003. The results of the survey show that Irish registered vehicles accounted for 165,625 or 11.5% of all the vehicles leaving ports in Britain in 2002. Irish registered vehicles accounted for 1.26 billion tonne kilometres (12.4%) of goods moved by foreign vehicles in Britain in the year. However, there is a distinct difference between the activity of Irish vehicles in Britain and vehicles from other countries. For most vehicles, the main purpose in moving freight through Britain is to deliver it within Britain or to collect freight for export. On average, transit through Britain accounts for only 7.4% of freight activity. Of the total carried in transit, Irish registered vehicles accounted for 71.9%, or 535 million tonne kilometres. Consequently, out of the total tonne kilometres for Irish vehicles operating in Britain, 42.5% represented freight in transit. Most of the remainder was accounted for by vehicles registered in the Netherlands and Austria suggesting that this too was freight being transported to Ireland.

It is clear from this survey that the amount of freight transported to and from Ireland via the landbridge through the UK is considerable. The data from the ports above indicate that the amount of LoLo that is routed through the UK with a 3rd country origin or destination is very small; a similar conclusion is likely in relation to bulk goods so that most of this freight transport will be composed of RoRo freight.

Data collected in the CSO Road Freight Survey 2002 provide an indication of the routes taken by RoRo freight leaving Ireland. The survey sample is rather small but the data are considered to be reliable enough so that they provide reasonably accurate indicative estimates. CSO port statistics for 2002 indicate that 3.93 million tonnes of cargo was transported from Ireland by RoRo. Of this, RoRo to Britain accounted for 3.72 million tonnes or just under 95%. The weights provided by the survey can be applied to these aggregate estimates to provide estimates for the routes taken by this freight.

The survey indicates that 59.5% of this freight, about 2.21 million tonnes, had a final destination in the UK. Onward transit to France accounted for 39.6% (1.47 million tonnes), while 0.9% (35,400 tonnes) travelled on by sea to ports in the Netherlands. This last flow had final destinations evenly split between the Netherlands, Denmark and Germany. RoRo that travelled onwards from the UK to France had destinations in a wide range of countries. The survey data show that 23.5% of this freight remained in France while 20.9% travelled North to Belgium and the Netherlands. This amounts to 8.25% of all RoRo freight from Ireland to Britain. A further 26.9% (10.6% of the total) went to Germany and Denmark while 3.6% travelled on the Sweden. Destinations in Southern Europe accounted for the remaining 370,000 tonnes. Map 5 shows the routes taken by the 3.72 million tonnes of RoRo that travelled from Ireland to Britain in 2002.



Map 5: RoRo Freight through Britain by Mainland Europe Port of Entry. (export tonnes)
Source: Logistecon analysis (2004).

4.0 Determinants of the Structure of Freight Routes

4.1 The Growing Importance of Logistics and Supply Chain Management

This chapter examines the impact of transport, logistics and supply chain management practices and priorities on maritime trade flows to and from Ireland. In particular the specific drivers and other contextual issues behind the preferred and heterogeneous routings for these freight flows will be considered. This examination is important for three reasons. First, it provides information in relation to the forces that have and will continue to determine freight transport flows and routes from Ireland. Second, it indicates the forces that will determine the future structure of flows, not all of which relate to the issue of costs as identified in this report. In particular it indicates the importance of including the costs of introducing change into any judgements regarding the opportunities that might exist for new routes. Finally, it provides a different approach to the analysis from what was undertaken above in relation to the economic drivers and the more formal analysis in the final parts of this report in relation to the potential impact of developments on non-operating costs on route structures.

Supply chain management (SCM) is a relatively recent (i.e. over the last two decades) phenomenon. In the competitive business environment of today it is now generally accepted that supply chains, and not individual firms or products, are the basis of much marketplace competition. The supply chain can be described as the end-to-end flow of materials, information and finance upstream from suppliers, via manufacturers and other value-adding entities, downstream to ultimate consumers via distribution channels[7]. In this sense the supply chain of necessity involves various, cooperating firms. For success in today's marketplace attributes such as branding and technological leadership are necessary but not enough: what is key is an efficient supply chain.

Starting with a situation of fragmentation where the various transport and transport-related functions – such as warehousing, purchasing, marketing, etc. – were viewed as vertically independent operations to be planned and carried out separately with maximum efficiency achieved through limited integration at key nodal points, the supply chain concept has developed as efficiencies were increasingly achieved through greater integration of these functions into an almost seamless operation. Increasingly, this is achieved through specialist service providers who may not own the products or who may not be involved in what was previously considered to be the key central operation of manufacturing. As a result, the manufacturing function increasing came to be seen as locationally footloose and driven by cost considerations further intensifying the importance of achieving efficient supply chains.

[7] There is a distinction between the terms 'supply chain' and 'logistics', although in practice both are often used interchangeably: logistics is a part of the supply chain but it is not the whole of it, whereas logistics generally concerns freight movement and handling, SCM is a much wider, inter-company boundary spanning concept involving a whole network of organisations.

Total logistics costs (packaging, storage, transport, inventories, administration and management) are variously estimated to reach up to 20% of total production costs and transport usually accounts for a quarter of these logistics costs. Therefore, for these networks of supply chains to function effectively it is necessary for efficient transport systems to be in place. Transport services (links in supply chains) and transport infrastructure (nodes in supply chains) are key elements in such efficient logistics systems and, accordingly, both ports and shipping services play a key role in supply chain competitiveness. In essence then ports and shipping services are the essential lubricants of the supply chain allowing such supply chains to function smoothly and efficiently.

4.2 Trends in European Transport and their Impact on Freight Flows

Table 4.1 outlines the modal shares for intra-EU goods transport in 2000, the % change in these shares over the preceding decade, and the forecasted growth (with and without policy interventions) for the subsequent decade.

Table 4.1: Intra-EU Freight Transport Shares.

Mode	Modal Share – 2000	1990–2000 Change	Forecast Modal Growth 2001–2010: Without policy	Forecast Modal Growth 2001–2010: With policy
Road	44	+34%	50%	38%
Rail	8	+6%	13%	40%
Inland Waterways	4	+18%	25%	40%
Pipelines	3	+8%	13%	13%
Sea	41	+33%	34%	40%

Source: European Commission / Allan (2003)[8]

A number of key trends are apparent from the table. First, road transport has a dominant share for intra-EU freight transportation, and is set to continue to grow going forward, although this growth may be dampened as the mode becomes a target for further policy interventions. The attractiveness of road transportation is easy to understand because of the quick, flexible, and reliable door-to-door services it can offer. The various externalities associated with road transportation, allied with increased congestion in Europe, render it a prime target for a policy response to dampen growth. It is not surprising then that the 2001 EU White Paper on Transport seeks to reduce growth in road haulage with supporting measures aimed at stimulating quite dramatic growth in other modes.

[8] Allan, J. (December 2003), The Kinnock lecture 2003, *Logistics and Transport Focus*, Institute of Logistics and Transport: Corby, UK.

The second significant observation to be drawn from Table 4.1 is the past and projected growth in the share of intra-EU shipping and the targeting of this mode by policy makers for further growth. Inland waterways and rail are also targeted for significant policy stimulated growth, although whether this can be achieved, especially for rail given its current low share, remains to be seen. The growth of intra-EU freight traffic is easy to understand with the addition of 10 more member states, a population increase of 75 million, an increase in land area by one third and an increase in economic output by one-third. This growth will be augmented by both increased globalisation of trade and productivity increases in transportation.

4.3 Logistics Network Configuration in Europe

Since the creation of the Single European Market (SEM) in 1992, there has been a shift by companies serving the region to view it as a single market. From a logistics standpoint, the challenge for such companies seeking to supply customers uniformly throughout Europe is to accept the differing requirements of customers in different countries and aim to exploit common processes where possible for fulfiling demand from these customers. One of the most prevalent logistical strategies for serving the European market has been the trend towards centralisation of inventory (Ruijgrok)[9]. Such centralisation of inventory often leads to increased freight movements across Europe. Meanwhile, economies of scale in terminal and vehicle operation have led to the concentration of international trade through a smaller number of hub ports and airports. Such network re-configuration has considerable implications for short sea shipping in Europe as, increasingly, intercontinental vessels only ply to the larger European ports which in turn are served by feeder services from regional ports. In terms of logistics service provision, the concept of a single provider of logistics services throughout Europe is, for many European manufacturers and distributors, an attractive, but possibly elusive, proposition.

As part of the analysis a series of discussions was conducted with various industry experts who indicated that the following factors can dictate the actual nature of maritime freight flows:

- Transit traffic mixing with point-to-point traffic: Intercontinental freight traffic increasingly enters and exits Europe only via selected gateway ports and corridors, with feeder services taking such freight on the first / final leg of its journey. An example in this regard is East Asian and Russian traffic entering Europe over Scandinavia and the Baltic Region and mixing with 'domestic' European traffic for the first / last leg of its journey from / to Ireland as appropriate. Shipping services to and from Ireland to these feeder gateways will thus develop not in response to 'domestic' European traffic but rather to feed the intercontinental traffic.

[9] Ibid.

- Large logistics hubs 'pulling' traffic in certain directions: The large third party logistics service providers (3PLs) are increasing the volume of traffic, which they handle in Europe. There is an increasing tendency for these 3PLs to route freight traffic via key logistics hubs for a variety of reasons, for example:
    - Individual shipments are often consolidated with other shipments in order to benefit from scale economies in transportation;
    - As well as providing basic transportation, many 3PLs also provide other value-added logistics (VAL) services at their hubs. Examples of such services include pick-and-pack, vendor hubbing, light manufacturing, merge-in-transit, cross-docking etc, thus necessitating shipment flows to and from these hubs.
- Differences within and between inbound and outbound freight rates: In 2002 some 32 million tonnes of freight were imported by sea into Ireland while under 13 million tonnes were exported. Clearly then more freight capacity is available for exports, resulting in lower freight rates, while considerably higher rates apply for import traffic. Individual shipments may thus take certain routings in order to leverage differences in freight rates.
- Factors surrounding port and shipping company choice: The decision regarding which port and shipping service to use is a key issue in determining the route that freight flows will follow. Shipping companies decide which ports they will ply to. This is not generally for technical reasons but is a result of their preferences, which in turn are dictated by their customers preferences. In turn the preferences of these haulage and logistics companies are dictated by their customers who are the ultimate consignors and consignees of the freight, which at some stage passes through the port. This complex, multi stakeholder decision making context is thus what dictates which route a shipment will take, and in many instances this routing is not necessarily via the most direct or obvious shipping service.

This analysis means that it is not possible to extrapolate that trade growth between two regions will automatically result in new and/or direct shipping services between these two regions. The shipping and logistics markets are much more complex than that. In addition, and in response to the wide range of factors that impact on final operating costs in these sectors, the structure of trade flows has evolved in such a manner as to maximise the returns to the major operators given the set of factors – including regulatory, cultural, geographical, cultural, technological and cost factors – that each has faced during the development of their organisation.

While freight handling structures will evolve over time, there is also considerable inertia to change. This inertia arises from three sources. The first is the complexity and the difficulty of identifying specific changes and the optimal way to address these. The second issue is risk and the specific risks that are attached to first-mover investments. Thus, while the economic centre of gravity may indeed be moving east, it would be expected that support firms would move at a relatively slower pace making only minimal incremental changes until a major movement becomes inevitable. Finally, there are large costs associated with moving major logistics centres and investment will be delayed until trade flows are large so as to shorten the pay-back period.

Furthermore, one factor alone is unlikely to achieve a major change in activities. This explains why efforts to change modal usage in Europe through economic measures have had limited results to date. Obviously cost factors are important. However, the key issue is in relation to who ultimately pays the costs. Faced with a situation where all transporters are faced with known, measurable and similar increases in road costs, and risks and uncertain costs if they undertake initiatives to avoid these expenses, there is a clear incentive to allow economic and market forces to allocate these costs towards consumers. In other words, the logistics providers in the absence of a major structural change to this sector can avoid most of the costs.

5.0 Policy and Cost Drivers

5.1 Review of Relevant EU Policy and Potential Grant–Aid

There are currently a number of relevant EU grant schemes along with schemes in individual member states for promoting short sea shipping and/or intermodal transport. In addition, in some cases general grant schemes are sometimes also applicable, although they are not specifically focused on short sea shipping or intermodal transport. Two European Commission supported schemes are 'Marco Polo' and the 'Motorways of the Sea'.

The Marco Polo programme supports actions in the freight transport, logistics and other relevant markets. The purpose of the programme is to help shift the expected aggregate increase in international road freight traffic to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible. The timeframe of Marco Polo is from 2003–2010 with a budget of €115 million.

The Marco Polo programme features three types of action:

- *Modal shift actions*, which focus on shifting as much freight as possible under current market conditions from road to short sea shipping, rail and inland waterways.
- *Catalyst actions*, which seek to change the way non-road freight transport is conducted in the community.
- *Common learning actions*, to enhance knowledge in the freight logistics sector and foster advanced methods and procedures of co-operation in the freight market.

The Motorways of the Seas initiative focuses on stimulating short sea transport on specific corridors. The EU decided to include this project in the list of Trans-European transport (Ten-T) projects. The motorways of the sea established four primary maritime transport networks within EU waters including a motorway of the sea of western Europe (leading from the Iberian peninsula via the Atlantic Arc to the North Sea and Irish Sea). A grant scheme is planned under this programme, but it is not yet clear in what way and under which conditions grants will be paid.

5.2 Planned New Toll Systems in Europe

The proposed introduction of the LKW-Maut in Germany is discussed below, as are plans in the UK for HGV road charging to take effect from 2006, although the exact start date is still not definite. Planned for introduction before now, but delayed for various reasons, the latest estimate for introduction in Germany of the LKW-Maut is early 2005.

5.2.1 LKW-Maut in Germany

The German Federal Government has decided to redistribute the costs of maintaining, expanding, and renovating German motorways among domestic and foreign users by introducing a toll on commercial trucking based on the distance travelled by all trucks weighing 12 tonnes or over. The time-based motorway toll (Eurovignette) will no longer be collected after introduction of the distance-based toll (LKW-Maut). All vehicles or vehicle combinations with a permissible gross weight of 12 tonnes and above, which are exclusively intended for use in transporting freight, will be required to pay this toll, regardless of their country of origin. Whether the truck is loaded or empty has no bearing on the duty to pay the toll which will apply to all German motorways, including service stations and rest areas. It also applies to urban expressways and begins with the ramp to the motorway. The introduction date of the distance-based toll was initially planned for August 31 in 2003, but has been postponed several times. Latest plans are to introduce the Maut in early 2005. Vehicle classification categories in preparation for this introduction are shown in Table 5.1.

Table 5.1: Vehicles Classification Based on the Current Toll Rate Regulations.

	Category A	Category B	Category C
Until 30 Sept. 2006	S4, S5 and EEV Class 1	S3 and S2	S1 and vehicles that do not belong to any pollution class
1 Oct. 2006 to 30 Sept. 2009	S5 and EEV Class 1	S4 and S3	S2, S1 and vehicles that do not belong to any pollution class
Commencing 1 Oct. 2009	EEV Class 1	S5 and S4	S3, S2, S1 and vehicles that do not belong to any pollution class

The amount of tolls payable per kilometre based on these classifications is shown in Table 5.2

Table 5.2: Current Toll Rates.

	Category A	Category B	Category C
Up to three axles	0.09	0.11	0.13
Four or more axles	0.10	0.12	0.14

5.2.2 HGV road charging plans in the UK

In April 2002, Ministers from both the UK Treasury and the Department for Transport announced that they would introduce a UK-wide road-user charge for all HGVs – including foreign HGVs – using UK roads. They promised that, at the same time, there would be offsetting tax cuts for the industry. Since that announcement, the Government has decided that the tax cuts will take the form of reduced duty on fuel for HGVs liable to the charge. Ministers hope that implementation of the charge will begin around 2006, but cannot be sure of an exact start date until it has been agreed with the market what can be delivered and thoroughly tested. Ministers will need to ensure that the right balance is struck between early introduction and quality and reliability. The proposed charge will apply to the use of UK roads by all HGVs over 3.5 tonnes. Unlike other EU countries, the UK has a comprehensive non-motorway network that is used for long-distance travel. Rates are likely to be structured so that heavier and more polluting HGVs pay a higher rate. It has also been decided to simplify the proposed charge so that it has no more than two basic rates (one for motorways and one for other roads) at least initially, although there may be additional variants on these rates according to time of day. No exact rates have been communicated so far.

5.3 Road Haulage Cost Drivers and Components

Cost data have been used, along with the data above on freight flows, to enable a statistical analysis of the potential impact of changes in underlying cost factors on the structure of flows. The methodology is based on the calculation of the percentage change in underlying costs that would occur as a result of the introduction of proposed road charges. Appropriate demand elasticities from the literature are then applied to these results to indicate the potential for this change to alter trade flows.

The most important cost drivers to be included in estimating the costs of road haulage are the vehicle type, the distance travelled in a year and the incidence of country-specific tolls and taxes. The costs have been calculated for a 44-tonne, 5-axle truck with trailer, which is commonly used in international transport on the Continent. It is assumed that the truck has a performance of 150,000 km's per annum.

The cost components associated with this truck can be split into four categories:

- Fixed cost
- Variable cost
- Staff
- Overhead

The rates, assumptions and calculations are based on road haulage cost analysis as used in TLN and the EU's COST-334 study that have been updated to reflect recent changes in some key figures such as fuel prices and other operating costs[10]. The fixed costs entered into the calculation include depreciation of the main components, interest, taxes, insurances and other fixed costs.

Depreciation is based on a new tractor unit costing €81,600 and a new trailer worth €13,500. These costs include items such as registration, transaction costs and other costs associated with property transfer. The calculation assumes a standard linear depreciation over 6 years with 150,000 km travelled per year. This gives a yearly cost of depreciation of €15,850. Interest is calculated at a rate of 8% per annum on the non-depreciated amount of capital invested. This amounts to an average of €3,804 per annum. Motor Vehicle Tax on this unit is estimated at €900 per year while the Eurovignette levy amounts to €1,250 per annum. This gives a total cost of €2,150 per annum. Insurance is assumed to include cover for 3rd party (i.e. civil responsibility), fire and theft, and includes a cost for relevant taxes on this item. This amounts to €4,800 per year.

Variable costs include fuel, tyres, oil, maintenance and repairs and motorway tolls. The cost of fuel is calculated on the basis of a trade price of €0.35 per litre, excise duties of €0.35 per litre, and consumption of 1 litre per 3.2 km over the assumed distance travelled of 150,000 kilometres per year. This gives a total cost of fuel (ex VAT) of €32,813 per annum. The cost of oil is also included at a rate of €0.042 per km. Based on the typical wear pattern of a tyre on a truck such as this, the cost per tyre is estimated at €0.002 per tyre per kilometre. Assuming 6 tyres for the tractor unit and 6 tyres for the trailer, this gives an annual cost of €3,600 for tyres. Maintenance and repairs includes an estimate for spare parts of €0.05 euro per km and labour costs incurred in maintenance of €4,800 per annum. Clearly, the cost of motorway tolls and trip permits is important for this analysis but it is not possible to place a value on this at this stage as it depends on the route that is taken. This is analysed below.

The final category of costs refers to staff operating costs and an estimate for overheads and the required margin. Driver costs are based on an estimate for wages and social charges in the Netherlands and amount to €47,960 per year. Overheads are estimated to amount to 15% of total costs while the required margin is estimated at 5% of costs. Together these items amount to an average cost of €1.06 euro per kilometre. These costs are used in the analysis in Section 6.

[10] Note that the cost items included are not necessarily Irish costs but average costs for north European country. These most closely correspond to costs in the Netherlands. To use Irish costs throughout would be to assume that the trucks using these routes are Irish. Not only is there no basis for this but it is also open for Irish operators to base their operations in the most economically advantageous location and pay local costs.

6.0 Statistical Analysis of Freight Transport Costs

6.1 LoLo Transport Costs on Irish SSS–routes

6.1.1 Short–Sea Shipping Routes in the Corridor

The scope of this analysis is defined by a framework of 19 destinations in the North-western part of Europe using Dublin as the origin point. This origin-destination model provides 19 different origin-destination (OD) relations that form the basis for defining intermodal door-to-door routes. Most of these routes involve the use of a transshipment port – either Rotterdam or Antwerp – but some involve the use of only 1 port. This analysis is not strictly based on the existing structure of flows – which, as discussed above, are in part the result of established routes and locations – but on the routes that would most likely be chosen if starting from scratch to minimise distance travelled.

In the case of 16 destinations, logic demands that only one preferable intermodal route is defined, but for the destinations of Warsaw, Krakow, Prague and Bratislava, it is necessary to define several alternative routes. As a result, the analysis is based on a total of 28 different routes that comprise the totality of OD relations. Two routes are distinguished in the case of Warsaw, one via the port of Gdynia and one via using the port of Hamburg. In the case of Krakow, it is necessary to distinguish three different routes, via the destination ports of Gdynia, Hamburg, and Rotterdam. For Prague and Bratislava, the model distinguishes four different routes in each case i.e. travel via Hamburg, Bremerhaven, Rotterdam or Antwerp as destination ports. The full range of routes including transshipment and destination ports is summarised in Table 6.1 opposite.

Table 6.1: Dublin-Destination Short Sea Shipping Routes in NW Europe.

Origin	Destination	transshipment port	Destination port
Dublin	Brussels		Antwerp
Dublin	Amsterdam		Rotterdam
Dublin	Hamburg	Rotterdam/Antwerp	Hamburg
Dublin	Bremen	Rotterdam/Antwerp	Bremen
Dublin	Dortmund		Antwerp
Dublin	Munich		Antwerp
Dublin	Copenhagen	Rotterdam/Antwerp	Copenhagen
Dublin	Arhus	Rotterdam/Antwerp	Arhus
Dublin	Oslo	Rotterdam/Antwerp	Oslo
Dublin	Goteborg	Rotterdam/Antwerp	Goteborg
Dublin	Stockholm	Rotterdam/Antwerp	Stockholm
Dublin	Helsinki	Rotterdam/Antwerp	Helsinki
Dublin	Tallinn	Antwerp	Tallinn
Dublin	Riga	Rotterdam/Antwerp	Riga
Dublin	Vilnius	Rotterdam/Antwerp	Klaipeda
Dublin	Warsaw	Rotterdam/Antwerp	Gdynia
Dublin	Warsaw	Rotterdam/Antwerp	Hamburg
Dublin	Krakow	Rotterdam/Antwerp	Gdynia
Dublin	Krakow	Rotterdam/Antwerp	Hamburg
Dublin	Krakow		Rotterdam
Dublin	Prague	Rotterdam/Antwerp	Hamburg
Dublin	Prague	Rotterdam/Antwerp	Bremerhaven
Dublin	Prague		Rotterdam
Dublin	Prague		Antwerp
Dublin	Bratislava	Rotterdam/Antwerp	Hamburg
Dublin	Bratislava	Rotterdam/Antwerp	Bremerhaven
Dublin	Bratislava		Rotterdam
Dublin	Bratislava		Antwerp

6.1.2 Transport Costs by Route

All routes include pre and post haulage by road. Pre haulage to the port of Dublin is assumed to be 30 km. The cost of this is based on the estimated price to transport a 40 feet container by road, without tolls and charges, of €1.06 per kilometre. Estimates of feeder prices for a 40 feet container between ports are based on a series of telephone interviews with liner operators. This work produced the prices shown in Table 6.2, including terminal handling costs (THC), for use in the analysis.

Table 6.2: Feeder Costs for Containers Between Ports.

Route	Cost	Operator
Rotterdam – Dublin	€525	BG Freight Line
Antwerp – Dublin	€525	BG Freight Line
Zeebrugge – Waterford	€613	C2C Lines
Rotterdam – Waterford	€900	Norfolk Line
Rotterdam – Bremen/Hamburg	€430	Unifeeder
Rotterdam – Felixstowe	€375	BG Freight
Rotterdam/Antwerp – Denmark	€550	Various
Rotterdam/Antwerp – Norway	€750	La Line
Rotterdam/Antwerp – Sweden	€585	Unifeeder
Rotterdam/Antwerp – Finland	€996	Containerships Ltd
Rotterdam – Tallinn/St Petersburg	€1,000	Unifeeder/Nord Container
Rotterdam – Poland	€675	Estimate
Hamburg/Bremen – Poland	€540	BCT

Using these data, the costs of door-to-door transport on the different routes can be calculated for the various routes in the analysis. These are shown in Table 6.3 on the next page.

Table 6.3: Cost Associated with Defined Short Sea Shipping Routes.

Destination	Destination Port	Road Cost	Sea Cost	Total D2D Cost	% Road Costs
Brussels	Antwerp	85	525	610	14%
Amsterdam	Rotterdam	117	525	642	18%
Hamburg	Hamburg	64	955	1,019	6%
Bremen	Bremen	100	955	1,055	9%
Dortmund	Antwerp	288	525	813	35%
Munich	Antwerp	843	525	1,368	62%
Copenhagen	Copenhagen	64	1076	1,139	6%
Arhus	Arhus	64	1076	1,139	6%
Oslo	Oslo	64	1275	1,339	5%
Goteborg	Goteborg	53	1110	1,163	5%
Stockholm	Stockholm	64	1110	1,174	5%
Helsinki	Helsinki	64	1521	1,585	4%
Tallinn	Tallinn	64	1525	1,589	4%
Riga	Riga	64	1525	1,589	4%
Vilnius	Klaipeda	361	1525	1,886	19%
Warsaw	Gdynia	420	1200	1,620	26%
Warsaw	Hamburg	956	955	1,911	50%
Krakow	Gdynia	685	1200	1,885	36%
Krakow	Hamburg	998	955	1,953	51%
Krakow	Rotterdam	1,367	525	1,892	72%
Prague	Hamburg	712	955	1,667	43%
Prague	Bremerhaven	737	955	1,692	44%
Prague	Rotterdam	1,001	525	1,526	66%
Prague	Antwerp	1,002	525	1,527	66%
Bratislava	Hamburg	1,062	955	2,017	53%
Bratislava	Bremerhaven	1,088	955	2,043	53%
Bratislava	Rotterdam	1,335	525	1,860	72%
Bratislava	Antwerp	1,269	525	1,794	71%

The various destinations can be categorised according to the percentage of road transport costs in the total costs. Obviously, destinations situated close to a port will have a small share of road transport costs in the total door-to-door costs, while destinations more towards central Europe will have a much higher share of road transport in the total costs. Doing this categorisation allows for the cheapest way to ship containers between Dublin and the various destinations to be estimated. This is shown in Table 6.4. It is meaningful to look at the balance of routes to the central destinations since it is expected that there is the greatest opportunity in these cases for substitution of existing routes, which utilise considerable overland travel with new routes that travel a greater proportion of the journey via sea. Four destinations appear particularly relevant: Warsaw, Gdynia, Prague and Bratislava.

The cheapest way to ship a container to Warsaw is via Gdynia. Though the sea transport is longer than to Hamburg, it takes a truck almost 7 hours shorter travel time to the destination as it travels only 420 km instead of 956 km if it uses Hamburg. In the case of Krakow, transit via Gdynia is also the cheapest way to ship a container although the difference with Rotterdam is small. Travel via Gdynia takes a truck more than 5 hours shorter travel time to the destination compared to road transport from Rotterdam (956 km as against 1367 km), but sea transport will take much longer. This makes Rotterdam more attractive as the port of destination on this route. For Prague, the cheapest way to ship a container is via Antwerp or Rotterdam. transshipment via Hamburg is slightly more expensive although it takes 3 to 3.5 hours shorter road transport time. This is insufficient to compensate for the difference in sea transport costs to Hamburg. The cheapest way to Bratislava is also via Antwerp. transshipment via Hamburg reduces road transport time by less than 2 hours, which is insufficient to compensate for the longer sea transport to Hamburg. In this case the difference is substantial with transshipment via Antwerp about €225 cheaper to use. In summary, therefore, with the possible exception of Warsaw where Gdynia offers a competitive alternative, the costs data back up the current structure of trade routes from Ireland, which are concentrated on transshipment through Rotterdam and Antwerp and overland transport to central European destinations.

Table 6.4: Categorisation of Routes According to Importance of Road Costs.

Category	Destinations and Routes
4-10% road costs	Hamburg, Bremen, Copenhagen, Arhus, Oslo, Goteborg, Stockholm, Helsinki, Tallinn, Riga (own destination port)
11-20% road costs	Brussels (via Antwerp), Amsterdam (via R'dam), Vilnius (via Klaipeda)
21-30% road costs	Warsaw (via Gdynia)
31-40% road costs	Dortmund (via R'dam), Krakow (via Gdynia)
41-50% road costs	Warsaw (via Hamburg), Prague (via Hamburg or Bremerhaven)
51-60% road costs	Krakow (via Hamburg), Bratislava (via Hamburg or Bremerhaven)
61-70% road costs	Munich (via Antwerp), Prague (via R'dam or Antwerp)
71% or more	Krakow (via R'dam), Bratislava (via R'dam or Antwerp)

Given this situation, the next stage of the analysis is to identify if the introduction of the proposed road charges would have a meaningful impact on this trade-off of road against sea routes and would thereby open up the possibility that new routes in the Baltic region would become competitive with the existing structure.

6.1.3 The Effect of Implementing Road Tolling in Europe on Costs

This analysis assumes that new road tolls will be implemented in Europe in the future. It is recognised that there is uncertainty regarding the timing and the precise nature of the regulations that have been proposed but there does appear to be a strong lobby at high levels in favour of the proposal. The analysis is based on an assumed average charge of €0.15 per vehicle kilometre for truck-trailer combinations. Given this charge, and assuming that there are no consequences for other taxes – for example it is assumed that there is no attempt to introduce a revenue neutral charge that would alter transport decisions but would not raise government revenue or that the revenue would be recycled directly back to those paying the new tolls – road transport costs on which the incidence of the toll falls would increase by 14%. This would have consequences for intermodal door-to-door costs between Ireland and the North European destinations. These are shown in Table 6.5, assuming that there is no response in terms of altering the route choice.

Table 6.5: Cost Impact of New Tolls on Specified LoLo Routes from Ireland.

Destination	Destination Port	% Price Increase Due to Tolls
Brussels	Antwerp	2.1%
Amsterdam	Rotterdam	2.7%
Hamburg	Hamburg	0.9%
Bremen	Bremen	1.4%
Dortmund	Antwerp	5.3%
Munich	Antwerp	9.2%
Copenhagen	Copenhagen	0.8%
Arhus	Arhus	0.8%
Oslo	Oslo	0.7%
Goteborg	Goteborg	0.7%
Stockholm	Stockholm	0.8%
Helsinki	Helsinki	0.6%
Tallinn	Tallinn	0.6%
Riga	Riga	0.6%
Vilnius	Klaipeda	2.9%
Warsaw	Gdynia	3.9%
Warsaw	Hamburg	7.5%
Krakow	Gdynia	5.5%
Krakow	Hamburg	7.7%
Krakow	Rotterdam	10.8%
Prague	Hamburg	6.4%
Prague	Bremerhaven	6.5%
Prague	Rotterdam	9.8%
Prague	Antwerp	9.8%
Bratislava	Hamburg	7.9%
Bratislava	Bremerhaven	8.0%
Bratislava	Rotterdam	10.8%
Bratislava	Antwerp	10.6%

Table 6.5 shows that there is a considerable range in the potential impact of road tolls on total transport costs. For many of the most important destinations the impact would be negligible. Even in the case of some quite easterly destinations such as Vilnius and Warsaw there is a less than 4% increase, provided the route chosen utilises ports in the Baltic region. This leads to the conclusion that the introduction of these tolls would have a small cost effect for Irish exporters and importers, provided shipping routes are adjusted to minimise costs. However, as discussed below, this conclusion does not mean that routes will be quickly adjusted and other cost considerations would be important.

It is clear from this analysis that there is a strong relationship between the share of road transport costs in total door-to-door costs and the impact of the proposed new charges on total costs. Table 6.6 shows this relationship according to the categorisation used above.

Table 6.6: Categorised Effects of Introducing Tolls.

Category	Destinations and Routes	% Cost Increase Due to Tolls
4 – 10% road costs	Hamburg, Bremen, Copenhagen, Arhus, Oslo, Goteborg, Stockholm, Helsinki, Tallinn, Riga (own destination port)	0.6% – 1.4%
11 – 20% road costs	Brussels (via Antwerp), Amsterdam (via R'dam), Vilnius (via Klaipeda)	2.1% – 2.9%
21 – 30% road costs	Warsaw (via Gdynia)	3.9%
31 – 40% road costs	Dortmund (via R'dam), Krakow (via Gdynia)	5.3% – 5.5%
41 – 50% road costs	Warsaw (via Hamburg), Prague (via Hamburg or Bremerhaven)	6.4% – 7.5%
51 – 60% road costs	Krakow (via Hamburg), Bratislava (via Hamburg or Bremerhaven)	7.7% – 8.0%
61 – 70% road costs	Munich (via Antwerp), Prague (via R'dam or Antwerp)	9.2% – 9.8%
71% or more	Krakow (via R'dam), Bratislava (via R'dam or Antwerp)	10.6% – 10.8%

The conclusion is that the effect on the door-to-door price of container transport between Ireland and the North-European region is almost negligible for final destinations situated in the direct neighbourhood of feeder ports. However, on routes where road transport costs exceed 30% of total transport costs, total costs rise by more than 5%. Where road transport costs exceed 70% of the total – as is the case on some routes to central Europe that travel via Rotterdam – the impact on total costs exceed 10%. With the exception of Munich via Antwerp, all destinations where the impact exceeds 7.5% of total

costs are in the accession countries where, as seen earlier, trade volumes are quite small. Furthermore, it cannot be concluded in the case of Munich that there is an alternative port available to reduce the percentage of road costs in the total and thereby reduce the impact of the tolls as it is relatively remote from North German ports.

For final destinations in central Europe (the southern part of Poland, the Czech Republic and Slovakia), the effect of the tolls on costs can add up to a price increase in door-to-door transport of 10% for transit through Rotterdam and Antwerp. It appears reasonable to suggest, that in some cases at least, this could be sufficient to lead to a different route becoming optimal, particularly one using a different transshipment port further east. Put another way, for freight forwarders in Ireland, the optimal hinterland region of the ports of Antwerp and Rotterdam for LoLo freight will have become smaller and would lead in some cases to an incentive to enlarge the proportion of sea-transport in the door-to-door route. However, this effect on the total trade is likely to be limited by a number of factors including switching costs, the longer travel time of sea transport which might be important in respect of certain types of cargo and the fact that the destinations where this is most apparent are relatively small in the overall structure of Irish trade.

6.2 RoRo Transport Costs on Irish SSS Routes

6.2.1 Routes and Costs

The market potential for door-to-door transport with RoRo containers differs from LoLo transport. In general, RoRo transport focuses on shorter door-to-door distances. The analysis that has been undertaken for LoLo is clearly heavily reliant on the availability of quite detailed data on trade flows and costs. As shown above, the data that are available for RoRo freight are somewhat more limited than for LoLo and the analysis has to take this into account. In particular, the routes taken by RoRo freight flows from Ireland relied to a greater extent on estimates based on surveys and there may be considerable statistical errors with such estimates. As a result, the RoRo analysis focuses on the European mainland to a greater extent and compares the landbridge alternative with direct RoRo connections between Ireland and the European mainland. In fact, this is not a weakness of the analysis since the limited competitive range of RoRo means that this trade-off between the use of the UK landbridge and direct sea transit to the continent captures the true decision making variables.

At the moment, Ireland's only regular RoRo connections are mostly to the UK and some services to France. The analysis proceeds by identifying a main freight route from Dublin to Dortmund. It is possible to identify five different routes from Dublin to Dortmund:

1. The UK landbridge route (Dublin–Holyhead) through the Channel Tunnel (Folkestone–Calais),
2. UK landbridge route (Dublin–Holyhead) via Southern England (Portsmouth–Le Havre),
3. The Northern UK landbridge route (Dublin–Holyhead) via Eastern England (Hull–Rotterdam),
4. Sea route via Cork-Roscoff to Dortmund, and
5. A potential new route utilising a new RoRo line from Dublin to Zeebrugge.

The road distances of these five routes are:

1. Dublin–Dortmund via Dublin–Holyhead and Channel Tunnel travelling Folkestone–Calais: 1,062 km (585 km in UK);
2. Dublin–Dortmund via Dublin–Holyhead and Portsmouth–Le Havre: 1,226 km (531 km in UK);
3. Dublin–Dortmund via Dublin–Holyhead and Hull–Rotterdam: 492 km (202 km in UK);
4. Dublin–Dortmund via Cork–Roscoff: 1,345 km (270 km in Ireland);
5. Dublin–Dortmund via Dublin–Zeebrugge: 362 km.

The two main items of cost are road transport and ferry costs. As in the previous section, a price of €1.06 per vehicle kilometre is assumed for a 40ft truck/trailer combination and the cost of land transport is calculated. The estimated costs of ferry transport are based on the UK Marine Motorway Study, in which the costs of high speed ferry transport are calculated. This gave a cost of €0.495, or €0.728 per trailer per kilometre. This excludes port handling costs of €40 or €58.80[11]. The resulting estimated costs of RoRo transport are shown in Table 6.7.

[11] Marchant, C. 'The effect of supply chain structure on the potential for modal shift: Evidence from the Marine Motorway Study'. Heriot Watt University.

Table 6.7: Cost of RoRo Transport Dublin to Dortmund (Alternative Routes).

Ferry 1	Ferry 2	Road Costs	Ferry Costs	Total Costs
Dublin–Holyhead	Folkestone-Calais (Channel Tunnel)	€1,128	€249	€1,377
Dublin–Holyhead	Portsmouth-Le Havre	€1,302	€321	€1,624
Dublin–Holyhead	Hull-Rotterdam	€523	€762	€1,284
Cork–Roscoff	None	€1,429	€386	€1,815
Dublin–Zeebrugge	None	€385	€808	€1,193

The important issue in relation to this table is not the overall accuracy of the absolute figures but the differences that are identified between the costs of the different routes and the share of road transport in these costs. Due to the longer sea-transport and shorter land transport in the total route, the routes via Hull/Rotterdam and Dublin-Zeebrugge have the lowest total costs. This would not seem to comply with the structure of transport identified above that showed a heavy reliance on the south of England routes. However, a key issue is that the landbridge route through the Channel Tunnel is by far the fastest way, with other south of England routes second fastest. Time is an important issue for much of the cargo that is carried RoRo – this is one of the main reasons for the choice of this mode over LoLo and the effective area where RoRo is competitive is determined by the area in which time savings are possible. That routes have not altered to reflect these cost differences is a strong indication that this is an important issue. This suggests that an effective trade-off to a new route would only be possible if it reduced time taken for certain routes *vis-à-vis* LoLo, thereby extending the competitive range of RoRo. It is unclear that the introduction of new tolls would be an important variable in this decision. This recognised, it is relevant to identify the potential for any change in road charges to alter RoRo routes towards new lines. The potential impact on cost is shown in Table 6.8.

Table 6.8: Impact of New Tolls on RoRo Transport Costs (Dublin–Dortmund).

Ferry 1	Ferry 2	Charge 15 ct/km	% Cost Increase	Total Costs
Dublin–Holyhead	Folkestone–Calais (Channel Tunnel)	€169	12.3%	€1,546
Dublin–Holyhead	Portsmouth–Le Havre	€195	12.0%	€1,819
Dublin–Holyhead	Hull–Rotterdam	€214	11.8%	€1,498
Cork–Roscoff		€78	6.1%	€1,893
Dublin–Zeebrugge		€58	4.8%	€1,251

The effect of an increase in costs due to introduction of road charges on these routes results in a total price increase in the range of 4.8% to 12.3%. The Channel Tunnel route will be confronted with the highest increase, while the short sea routes via Hull–Rotterdam and Dublin–Zeebrugge will have a lower impact on the cost level. This is potentially important. It means that the greatest increase is felt on the currently most popular routes. These increases are also greater than was generally observed in the case of LoLo and also apply to a much greater proportion of total Irish trade. This suggests either that the currently competitive area of the RoRo mode will be reduced on existing routes or that new routes will emerge to retain or expand the area. However, as discussed already, this conclusion is based on costs alone and the time element will be important in determining the actual response of freight forwarders to this change in relative and absolute costs.

6.3 The Effects of Cost Increases on Modal Demand

6.3.1 Applying Demand Elasticities

The final step in this analysis is to estimate the impact of these alterations in costs and relative costs on freight flows. There are two potential sources of impact. The first is that the new tolls through increasing the cost of transport act to reduce the overall freight flows. The consultants are of the opinion that this impact is negligible given the strong growth path of international trade, the fact that transport costs are a relatively small portion of the overall costs of production and the fact as discussed above that the cost changes on Ireland's main freight flows will be small. As a result, this impact is excluded from the analysis.

The second way in which new tolls will impact on freight flows is through altering the relative costs of different modes and routes. The analysis above shows that an increase in the cost of road transport results in a competitive gain for intermodal trips, which have a higher share of sea transport in the total route. This opens the possibility of opportunities for new short sea shipping lines or expansion of existing lines. The extent to which there will be a response by the market depends on the price elasticity of existing routes and on the availability of an alternative[12]. If an alternative does not currently exist then the analysis points to the possibility of a new route to meet what is in effect a new source of demand. Thus, having identified the percentage changes in costs, elasticities can be applied to indicate the likely change in demand. It should be possible to translate this into an estimate for freight for a new service.

[12] Here, price elasticity of demand is defined as the proportionate (percentage) change in demand for a transport service divided by the proportionate change in the cost of that service.

This raises a problem for the analysis since no elasticities for demand are available and there is insufficient data available to allow them to be estimated. Indeed, given the relatively small number of alternative routes that are currently available and the issues discussed later in this section, it is arguable that it would be impossible to identify reliable data allowing elasticities specific to Ireland to be identified. For this reason it is necessary to use estimates from the literature.

In the door-to-door corridors defined for both RoRo and LoLo, a choice exists between landbridge routes or intermodal routes with direct SSS connections to the European mainland. The parameters of this choice show similarities to the choice between road transport or intermodal road-inland shipping transport on the European mainland. Price elasticities for this choice have been calculated in research sponsored by the European Commission[13]. The main similarity is that in both the current case and in the EC funded study; the change in costs arose as a result of a policy decision with the effect of increased internalisation of external costs in road transport. In effect, the results of the 1998 study are being applied here to give an indication of the expected impact of a further move in this direction, although it is recognised that the modal shifts under discussion – from road to inland waterway in the earlier study but from road to sea in the current study – are different.

The cross-price elasticity of road transport costs on demand for inland navigation for NSTR-category 9 (general cargo and containers) was estimated in the study at 1.05 in absolute values. This means that a price increase of 10% in road transport would be expected, everything else held constant, to result in an increase in the volume demand for the alternative of 10.5%. In the view of the consultants, this estimate of elasticity is sufficiently close to mean that an elasticity of 1 can be assumed. This is acceptable from a theoretical point of view since in an industry with a limited number of alternatives, the potential for strong long term relationships to emerge and, particularly, where there are large capital costs, there is an incentive for service suppliers to adjust prices to a level where elasticity will approach 1. A different way of saying this is that there is an incentive for shipping services suppliers to maximise capacity and revenues given the high fixed costs with which they are faced. This is a reasonable statement in relation to this industry.

One final point also needs to be recognised. While there is a relative gain for some routes over others due to lower cost increases, there is an actual cost increase for all routes. Thus, while an elasticity of 1 implies that there will be a similar change in percentage demand to the percentage change in price,

[13] Meersman and van der Voorde (1998), *Sort-It D4 Final Report on Modelling: Appendix D Modelling Inland Navigation.* Report to European Commission. This methodology has been applied in the Seine Scheldt corridor study in order to asses the effect of the European policy to internalise external costs of road transport on the volume of inland navigation on the River Leie in Belgium.

there is also a counteracting effect as a result of the increase in the price of the route where there has been a competitive gain. Thus, the modal or route shift will not be given simply by the percentage changes in costs but by the differences in the changes between alternatives.

6.3.2 Impact on Trade Flows

Estimating the impact of these cost changes on trade flows involves the application of elasticity estimates to the relative changes in costs to provide the estimate for the change in demand. In the case of LoLo, the consultants are of the opinion that relative cost increases of less than 3% will have a negligible effect on route decisions for a number of reasons. First, the data cannot be considered to be sufficiently precise to allow for conclusions to be drawn at this level of detail, particularly since there is uncertainty regarding the precise regulations that might be introduced. Second, operators may be in a position to defray some of these costs without changing current operations. Finally, as discussed below, inbuilt resistance to change and risk will mean that firms will not react in the form of introducing major changes in operations in response to relatively minor changes in the cost environment.

As a result, routes where road costs are less than 30% of the total cost will not be affected. This covers all trade with Belgium, the Netherlands and Scandinavian countries[14]. The situation for Germany and Eastern Europe is different. Routes to Germany via Rotterdam and Antwerp will have cost increases in excess of 5%. Since the tolls will apply in Germany, there will be opportunity to offset some of this cost for parts of Northern Germany near the ports. However, beyond a quite limited radius – of probably no more than 50 to 100 km – of these ports, this opportunity will disappear. Thus, it would appear that there is just a limited opportunity for some diversion of trade to a short sea route carrying German trade to Hamburg port. The available data do not allow for the destination of Irish trade with Germany to be identified on a regional basis but the trade from Rotterdam to Hamburg that would be affected by cost increases would be unlikely to exceed 10% of total German trade. At an average increase of 5% in costs and an elasticity of 1, this suggests that only 0.5% of German trade will be affected. In 2002, this would have amounted to about 2,500 tonnes of Irish exports and 5,000 tonnes of imports to Ireland. A portion of this is already carried on the existing Dublin Hamburg route.

[14] It is important to note that this is not a conclusion that new routes to the Scandinavian countries will not exist. Rather, the conclusion is that the introduction of the tolls does not create the impetus for these routes to emerge.

In terms of LoLo TEUs to Germany, the data indicate that in 2002 exports to Germany and Denmark though Belgian and Dutch ports amounted to 101,901 TEUs and imports to 113,281 TEUs. About 88% of the total – 189,227 TEUs – passed through Dublin Port. Allocating this according to the distribution of overall trade between Denmark and Germany – CSO data indicate that 88% of the total is with Germany – indicates that about 90,000 TEUs exports and 100,000 TEUs imports may be affected by the introduction of the tolls. With a 5% increase in costs and an elasticity of 1, this means that about 9,500 TEUs per annum could be diverted. On the basis of the growth projections in this report and if the average weight of a TEU were to fall by 10% then this would rise to about 12,200 in 2008. This would suggest that there will be an impact and an opportunity to divert trade to avoid the tolls. However, the question is, to what port would this LoLo trade divert? If it goes to Hamburg then the gain will be limited to only certain areas of Northern Germany while diversion to ports further east would add to the journey time and would not eliminate the cost of the tolls completely. Given the switching costs that would be involved in such a change, the likelihood of actual savings accruing would be limited. Thus, there would appear to be only a very limited opportunity for a new route to service German trade with perhaps 1,500 TEUs currently going to/from Germany through Amsterdam and Antwerp diverting to this route.

The results with regard to the accession countries suggest that there may be opportunities for the diversion of trade from Antwerp and Rotterdam to Gdynia or Riga. The data indicate that in 2002 about 12,800 TEUs of Irish exports and 8,822 of TEUs of imports LoLo travelled between Ireland and the new EU members in the study area. By 2008, if the average weight per TEU falls by 10% then this will have increased to 17,700 TEUs of exports and 12,673 TEUs of imports. These destinations will experience cost increases in the region of 10% on existing routes but this increase would be limited to around 5% if the trade was diverted to Gdynia or Riga. There would not appear to be any advantage in diverting to Hamburg as most of the tolls would still be payable. If the elasticity estimate of 1 is applied, there could be an opportunity for a new route to this area handling 1,500 TEUs of trade. However, once again, the question is whether this volume and the switching costs involved would make this route viable. The conclusion is, given the eastern expansion of the EU and the opportunities for growth, that this is a real possibility in the longer term although the emergence of this route within the time period up to 2008 is uncertain. In summary therefore, the analysis indicates potential for a new LoLo route through Gdynia or Riga handling in the region of 3,000 TEUs to emerge but that the switching costs may mean that a greater volume will be required before this emerges.

In the case of RoRo, the data indicate that a new route serving Zeebrugge directly would both reduce the current cost of RoRo delivery to the continent and would gain market share relative to existing routes if new tolls were introduced in the UK and Germany. Under the existing situation, alternative routes using the South of England are currently 26% more expensive than a possible direct Zeebrugge route. With the introduction of tolls, this cost advantage would increase to about 35% for delivery to Dortmund. Delivery to areas in Belgium and the Netherlands would have a larger percentage gain. The percentage gain relative to the north of England route will also be larger. However, the Cork Roscoff route is unlikely to be affected to any degree.

This would appear to suggest that there is an important opportunity here. However, the question needs to be asked why, with a 26% cost differential already existing on this route, no such route is in operation? The answer would appear to be that RoRo traffic places a much lower emphasis on cost and a higher emphasis on timeliness and the Zeebrugge route would be somewhat slower than the existing routes. However, leaving this aside, if the cost differential increases to 35% compared to the current routes, there would be an opportunity here for a meaningful diversion of traffic. The data earlier in the report estimated that about 40% of RoRo tonnage from Ireland to the UK travelled onwards to France or the Netherlands. This amounted to about 1.5 million tonnes. With a demand elasticity of 1, the expectation would be that in the region of 135,000 tonnes of this, in each direction, would be re-routed.

At an average weight of 15 tonnes per RoRo unit, this would amount to 9,000 units in each direction in 2002. The total weight of freight carried by RoRo grew at close to 20% per annum in the period 1995 to 2002. This is unlikely to be maintained. However, if it were to grow at 10% per annum in the period 2002–08 then this would suggest an opportunity for a route handling in the region of 16,000 RoRo units in each direction on an Ireland–Zeebrugge route in 2008.

6.3.3 Relevant Limiting Factors

Some important points are worth noting in terms of the approach that is taken here. First, the available data and the scope of the current project do not allow for new elasticities specific to Ireland to be calculated. This raises the possibility that elasticities from elsewhere may not be exact and so the results should be interpreted as best estimates or mid-points within confidence intervals. It is not unusual for this to be necessary and does not imply that the results are thereby devalued since there is nothing to suggest that the elasticities taken from the literature are inappropriate or that Irish conditions would lead to different values.

Second, the methodology is one of comparative statics i.e. it calculates the impact of a change in one variable on a starting situation to indicate an outcome. In the world of business, such a modelling of business decisions may be overly simplistic since there may be opportunities for operators to offset costs through some unforeseen alteration in operations or perhaps through passing on the cost if competitive conditions allow this to happen.

Third, the relative imbalance in the weight of Ireland's imports and exports is a problem that may get worse in the medium term. This imbalance varies according to the trading partner but is particularly pronounced in the case of the accession countries. The response to this to date has been to limit the number of ports to which services to Ireland call since this allows for the different extents of the imbalance to be averaged across a wider range of countries. This does not eliminate the problem but it moves it closer to an imbalance of 2 to 1 rather than the 10 to 1 that exists in relation to the relative weight of imports and exports to the accession countries. New routes could use pricing to ease this problem or a more complex structure than just a single origin and destination port but it is an issue that is likely to limit new routes.

Finally, and perhaps most importantly, this methodology does not include switching costs and inertia. For example, the methodology might indicate that a rise in costs on some routes would lead to changes in the competitiveness of alternative routes and would alter operations. However, as discussed earlier, trade routes rely on the existence of established facilities and many of these require capital investment and the development of information datasets. Changing to a different structure of flows, even where such a structure would result in lower transport costs, would imply considerable capital investment and the possibility of creating stranded assets. This would be most important in the case of LoLo or where loads from Ireland needed to be broken and re-compiled for further transport to final destination. In addition, there would also be risks involved in being a first-mover to a new location or route structure. This would offset some of the potential gains from accessing the cost advantages that might accrue.

As a result of this final point, there is a clear incentive for business decision makers to remain with existing structures until there is a substantial difference between the costs associated with persisting with existing trade flows and adopting new structures with the attendant capital investments required. In other words, while the statistical model implies that an incremental change in flows will result, the structure of the business means that a large step change is more likely to occur after a period rather than a gradual alteration of activity. The cost changes identified, while suggesting in the statistical model that new opportunities might emerge, are relatively small in most cases and would not in themselves be sufficient to result in a major restructuring of trade flows in the short to medium term. However, over a longer period, when taken in the context of the eastward shift of economic activity in Europe, this situation could change.

7.0 Findings and Recommendations

7.1 Opportunities for New Short Sea Routes

The analysis of the structure of Irish trade flows in this report has been undertaken in the context of three important trends and developments that have determined the structure of the report. These are:

- Ongoing growth in the value of Ireland's trade but changes in the structure of this trade;
- The accession of the countries of central and eastern Europe to the EU; and
- The proposed introduction of road tolls specifically in the UK and Germany.

The core hypothesis that provides the rationale for the work is that these factors will provide opportunities for the development of new short sea shipping routes between Ireland and Northern Europe to avail of the increase in demand for shipping as a result of the growth of trade between Ireland and economies in the Baltic region and the diversionary impact of the increase in road transport.

In addition to compiling a dataset that describes developments in Ireland's trade flows and the routes taken, the work contains three distinct pieces of analysis that address aspects of the topic from distinct perspectives. These are, in turn:

- The potential impact of the structure of trade and new trade partners on freight flows;
- The impact of the existing freight handling infrastructure in Europe on this structure; and
- The impact of the changes in relative costs on the decisions freight forwarders in choosing routes and modes for the transport of Irish inward and outward freight.

The dataset shows that Ireland has a somewhat unusual structure of freight handling with two ports – Rotterdam and Antwerp – dominating in LoLo and the UK acting as a landbridge for a large proportion of RoRo freight destined for continental Europe. The initial conclusion therefore is that landbridges in the UK and Continental Europe are an important characteristic of these flows and that there could be potential for changes in relative costs to alter this structure in favour of a greater proportion travelling by sea to ports closer to the final destinations. However, the subsequent analysis results in a more complex outcome.

Closer analysis of flows with the study region identifies three important aspects that will affect the viability of any new route. First, trade with the accession countries is a very small part of Ireland's overall trade flows with the region. As a result, the eastern expansion of the EU, while providing an impetus to growth and integration will lead to growth from a very low base. Thus, the effect in the short to medium term of overall flows will be marginal. Second, there is a continuing and rapid trend for the overall weight and volume of Ireland's trade to decline. The evidence suggests that this will continue so that while there is continuing growth in the value of trade, the actual amount of freight to be moved will not grow rapidly. A further aspect of this has been that there is a growing need for more frequent delivery of finely timed freight at least in markets in Western Europe and this could be seen in the East in the future also. Third, this fall in the volume and weight of trade per unit of value is much more rapid for Irish exports as the economy restructures towards more high value knowledge intensive exports. The result is a growing imbalance in the weight of imports relative to exports. This is particularly noticeable in trade with the accession countries and has implications for the viability of any new routes.

As a result of these features of Ireland's trade flows, it cannot be concluded from this analysis that the accession of new member states to the EU and the ongoing eastern movement of economic activity in Europe would be likely to have a major impact on the structure of Ireland's trade flows. As a result, this development, while indicating the possibility that new trade flows could emerge, does not in itself provide a strong basis on which to suggest that there are viable opportunities for new sea routes to be developed.

The second element of analysis concentrates on the handling and management of freight in Europe and provides a fairly definite conclusion. Logistics has emerged as a key competitive weapon for firms and this has been particularly important for Ireland as a result of the decision of some major firms to locate European service centres in Ireland and the relative peripherality of the country. However, the implication of this is not that there must be a particular usage of transport modes but that the available modes must be highly efficient. As a result, logistics operators have developed complex freight handling systems and have invested heavily in infrastructure and in supporting systems. Two features of these systems are particularly evident. First, they are centred on a small number of locations that have been deemed to be the most efficient from a number of points of view, in particular Rotterdam and Antwerp in the case of freight flows to Ireland, although other centres have also been developed. Second, the systems have been designed to maximise economies of scale which preserving flexibility in terms of the allocation of particular origin-destination pairs to particular routes. The key to this is centralised freight handling and warehousing with bundling and unbundling operations as required.

These developments have important implications for the structure of freight flows and the response to changes in trading relationships and relative costs. In effect, they enhance the flexibility of operations in terms of on-land transport but restrict the number of port-to-port pairs that can be serviced. Furthermore, in an era of change, there are very high switching costs due to the need to relocate key strategic assets and the possibility of creating stranded assets. As a result, change will not take place in an incremental fashion in response to marginal changes and there is likely to be considerable inertia in the short and medium term. In the longer term, if the change in trade flows is sustained and if the change in relative costs is maintained then a step change in the structure and location of assets for handling freight would be expected. For the issue under discussion in the current project this means that the viability of new routes would be restricted since they would be unable to access the economies of scale that exist in centralised freight handling system and would risk being outside the mainstream in terms of the main flows. However, the longer term possibility will continue to exist.

The third element of the analysis is a statistical analysis of the relative costs and changes in these costs that will occur as a result of the proposed introduction of road charges. The analysis indicates that there is some potential for the development of a new route serving Eastern Europe with LoLo freight and also a new RoRo route bypassing the UK landbridge into northern Europe. The conclusion is based on the analysis of changes in relative costs only but the data suggest that there would be sufficient volume to make these routes viable. However, the imbalance between the volume of imports and exports in the case of Eastern Europe and the importance of time in determining the competitiveness of RoRo routes suggests that the cost issues in themselves might not be sufficient to alter route choice by the freight forwarders.

The overall conclusion from the analysis therefore is that there is indeed potential for new routes to emerge as a result of the proposed tolls, but that the implied cost changes might not be sufficient to alter existing flows. Overall, the new costs will not impact greatly on Irish transport costs although there are implications for some routes. Given this situation, the question arises whether there is a role for policy to intervene to enhance the impact of the cost changes and bring forward a response in the shorter term?

Two areas of EU policy are relevant in responding to this question. First, the new tolls are being introduced not to raise revenue – and indeed there is a strong argument that they should be introduced on a revenue neutral basis – but to elicit a response by diverting more freight to short sea from roads.

What this study shows is that, in the case of Ireland, the impact will be limited by the perception of risk on the part of decision makers and the sunk costs that characterise the industry. Second, it is clearly in the interest of the EU to integrate the countries of Eastern Europe as comprehensively as is possible. However, the analysis suggests that the tolls in Germany in particular will act to place trade with these countries at a relative disadvantage when compared to trade between countries where the freight does not have to cross Germany. This would clearly be disadvantageous and requires that the potential costs are avoided, i.e. it supports the argument that the tolls should be revenue neutral for trade crossing Germany to another destination. One way to achieve this would be to use the revenue to enhance the cost differentials that have been created and promote short sea routes.

This provides the rationale for intervention on two fronts: tolls to make road transport less attractive and incentives to enhance the competitiveness of shipping. This is the approach that the EU has developed with its programmes an it is important that these opportunities are fully accessed by Ireland if there is going to be a change in the structure of trade flows that provides opportunities for viable new short sea routes in the short and medium term.

7.2 Areas for Policy Development

The conclusions of this work indicate that there is an opportunity for Irish policy to encourage the development of new short sea routes but that these might not emerge in the absence of incentives, although a number of current developments mean there is an environment in which change is possible. This indicates three general areas in which policy can operate.

The first is in promoting change through providing information and research on new opportunities as they emerge. This report has identified reasons why there might be resistance to change due to sunk costs even when more efficient operational structures emerge. The best way to get over this problem is through ensuring that there is a high degree of competition in the sector. Along with financial requirements, knowledge can act as a barrier to entry. However, by promoting new possibilities, policy can encourage action and new competition more rapidly than might otherwise be the case.

The second area is in direct promotion of new routes through subsidies. This research indicates clearly that while there are forces that will promote the development of new routes serving Eastern Europe, these forces are unlikely to be sufficiently strong, in the absence of intervention to enhance the cost differentials, to cause a major shift in the underlying factors that determine the structure of trade routes.

Third, it is essential that Irish ports are able to handle ships utilising the new routes and new modes of freight movement. The major growth that provides for the possibility of new short sea routes is unitised freight. However, research reviewed in this study indicates that a number of Ireland's most important ports will experience constraints on their ability to handle this freight efficiently in the medium term future. Any failure in this regard would have serious consequence for the ongoing competitiveness and development of the economy and would lead to strategies that could resist change on the part of operators faced with these new difficulties.

7.3 Recommendations for Further Work

Two distinct areas for further work came to the fore during our discussions and analyses:

- The impact on the Irish economy of road charging in the UK on both Irish trade with the UK, and in particular on HGV traffic transiting the UK enroute to Continental Europe, should be urgently and comprehensively examined.
- Significant difficulties were encountered during the course of our research with regard to sourcing particular types of maritime freight traffic statistics (e.g. identifying the actual routings which freight shipments take). Clearly the extant raft of statistical data, which is currently published, is very useful, but user needs do evolve over time. In particular we would suggest that the Central Statistics Office discuss with the relevant stakeholders their statistical requirements and how such statistics could best be collated going forward. A useful template may be the way in which data is collected on international passenger movements at Ireland's ports and airports.

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IMDO-Ireland
Marine Institute Foras na Mara

The Irish Maritime Development Office, Marine Institute
80 Harcourt Street Dublin 2

telephone + 353 1 476 6500
facsimile + 353 1 478 4988
email imdo@marine.ie
website www.imdo.ie